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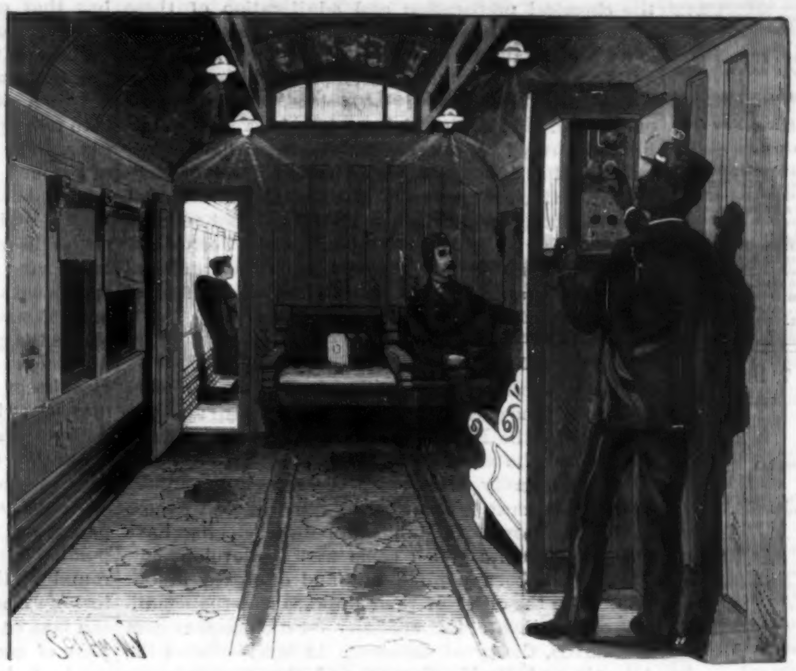
THE JULIEN SYSTEM OF LIGHTING RAILROAD CARS.

In the illustrations accompanying this article we show the application of the electric light to the illumination of cars. The apparatus consists of incandescent lamps, supplied by storage batteries of the Julien type. A number of cars, sleeping, parlor, and ordinary ones, and even a baggage car, are now thus lighted, and it is fair to assume an extensive introduction of the system. The public attention has been so forcibly drawn to the dangers of kerosene lamps on railroads, that special interest attaches to the subject of the electric lighting of vehicles of travel.

The installation on different cars varies in the number, character, and distribution of the lamps. The plant in all the cases we allude to comprises a storage battery. The battery is of the type manufactured and supplied by the Julien Electric Co., of this city. This is carried in a receptacle beneath the longitudinal center of the body of the car and to one side of it. From it one or more circuits are carried through the interior of the car. On them the lamps are arranged in parallel or, as it is freqently called, in multiple arc. Edison or Weston lamps are used, and suitable switches provided for turning all or part of the lamps on and off.

The illustrations represent the system as applied to a parlor car upon the New York Central Railroad. Thirty cells of the Julien storage battery supply the electricity.

They are charged from an Edison dynamo, driven by a horizontal engine. Two independent circuits are supplied by it. One is used directly for lighting purposes in the depot. The other, an independent con-



SWITCH BOARD IN CAR.

nection, is for charging the storage battery. On each circuit is placed an ampere meter, so that the proper current for one or the other purpose can be supplied.

The storage battery wires run to the main floor of the building and terminate at a charging bench, their terminals being springs fastened down upon the surface or "seat," one at each extremity. If a cell were placed upon the bench and its proper terminals connected respectively to the right and left hand springs, it would be in a position to be charged by the dynamo.

Intermediate springs, connected in pairs, are also attached to the bench. The batteries are contained in boxes, six cells to a box. Upon the bench there is room for six of these cases. The terminals from the cells in each box, which cells are arranged in series, are carried down to two opposite corners at the front. When the six boxes are in place on the bench, their terminals press upon the springs, completing the circuit by means of the series of batteries, throwing thirty-six cells in series into the portion of the circuit included between the terminal springs at the extreme ends of the bench. If less than the six boxes are to be charged, a piece of wire is used to bridge over the vacant place and connect the adjacent springs. In the particular car we are describing only five boxes are used, and the above connection is applied to the charging bench.

To charge the cells they are ranged in order on this bench and the current from the dynamo is turned on. It is maintained at a potential difference of seventy-five volts and at an

(Continued on page 294.)

THE JULIEN SYSTEM OF LIGHTING CARS.—PUTTING IN BATTERIES.

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NEW YORK, SATURDAY, MAY 7, 1887.

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(Illustrated articles are marked with an asterisk.)

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SCIENTIFIC AMERICAN SUPPLEMENT

No. 592.

For the Week Ending May 7, 1887.

Price 10 cents. For sale by all newsdealers.

FRENCH EXPORT WINE.

United States Consul Gifford, at Bordeaux, warns the American public to beware of French liquors, more especially brandy, for that *no pure French brandy* is sent hither. After commenting upon the methods employed in making brandy for export, he goes on to say that the labels on the bottles do not represent the quality of the liquid they contain. The dates 1863, 1870, 1875, etc., do not, he says, mean that the inclosed liquid is brandy put up in those years. It means that the liquid has been made to resemble as closely as possible that which was really made in those years. In other words, the brandy sent hither from France is spurious, a concoction put up in the laboratory, in which the taste of good brandy is counterfeited by various chemicals.

It is worthy of comment that, while the laws against selling spurious wines and liquors in France are rigid in the extreme, little or no attempt is made to prevent the chemical preparation and adulteration of these liquids for exportation. Quite recently, the proprietors of a Paris restaurant were arrested and tried for selling a wine which, by its composition, must have been intended only for export. It was colored with an extract of coal and mixed with plaster of Paris—a pretty combination truly! A man and his children who drank it testified that it had "a very pleasant taste of raspberries," which shows what imagination will do. But even so strong an imagination as this was not equal to withstanding the effects of the wine, and a doctor had to be called in. The suit was brought by the Municipal Laboratory, and the punishment inflicted a fine of 1,000 francs and one year's imprisonment.

PANAMA CANAL DIFFICULTIES.

The prospects for a canal at Panama seem more illusive as time goes on, and not even the skill and perseverance of the French engineers has, so far, sufficed to lend to the scheme the air of practicability. Indeed, the tenacity with which these engineers adhere to the work must be regarded as remarkable by those who know how formidable and disheartening have been the obstacles which came with its development. These have been pointed out and discussed in our columns in the order of their appearance—the deadliness of the climate, the necessity for a monstrous dam at Gamboa, the great difference in level between the Atlantic and Pacific Oceans, and the disappointing character of the rock to be cut into in the mountain section.

Now comes the news from Panama that fully fifty per cent of the excavated material from the sections of the canal route is washed back again by the floods, and that this has been going on year by year ever since work was begun, without any announcement of the fact in the reports. The contractors working in the various sections are paid certain rates per cubic yard for material taken out, and if any part of this is washed back again they must be paid for once more removing it at the same rates as when first handled. Thus the company has been, and is, paying over and over again for the handling of much of the excavated matter, and, because of the continual floods and freshets, is never sure of keeping it permanently out.

For four years the engineers have been studying the problem as to how the furious floods of the Chagres River can be stayed or checked—as yet, without finding a solution. A recent writer on this subject makes the following interesting quotation from page 55 of the Manchester Geographical Society's journal for the first quarter of the year 1886:

"The Chagres is a torrent on the scale of a river, which intersects the proposed bed of the canal at twenty-nine points, and, when swollen by rains, sometimes raising its level thirty or forty feet in a day, discharges upon the valley a flood volume four times that of the highest ever measured on the Thames. The proposed remedy is to dam it up in a lateral ravine, through which it leaps down at right angles to the canal trench, by an embankment, whose mass of 20,000,000 cubic meters, with a base of 960 meters, would measure nearly a mile in length and 148 feet high. This mighty barrage will hold a milliard cubic meters of water suspended on the flanks of the mountain in a colossal basin twenty miles in length, which, if filled at the rate of a cubic meter a minute since the Christian era, would only begin to overflow in 1903."

So far, out of a total of 200,000,000 cubic meters of material to be excavated (not counting back wash), 37,727,000 had been taken out up to last January, thus leaving 162,273,000 yet remaining. The amount expended is said to have been $60,000,000 in stock and $240,000,000 in bonds.

The Link Belt Machinery Co. of Chicago.

The United States Court has decided that the drive chain heretofore made by the Moline Malleable Iron Co. is an infringement, and they have been enjoined from the further manufacture. The company has settled all claims for damages, and no suits will be brought against their customers. The Link Belt Machinery Co. of Chicago will hereafter furnish repairs for the Moline Co.'s chains now in use.

Breaking Glass Tubes.

Small glass tubes, less than five-eighths inch in diameter, give no trouble at all in breaking to any desired length, provided there are two or three inches to be broken off. Make a deep scratch—it need not go far round—on the tube, and then, with both thumbs close together, pull strongly and bend from the scratch. Tubes from three-eighths inch to one inch in diameter may be cracked by making a scratch as before, and heating circumferentially in a blowpipe flame. The flame should be very small, and the tube turned rapidly to prevent irregular cracking. Heat as small an area as possible on each side of the crack. If the glass is not very thick, about half a dozen turns will be enough to heat it sufficiently. As soon as this is done, take it out and blow sharply with the breath just on the scratch, and a beautiful clean crack will spring partly round. The parts may then be pulled asunder. This is a very successful method with English glass, but that of German manufacture is apt to fly unless carefully done.

Perhaps the easiest way for tubes that cannot be pulled asunder cold is to make the scratch and then dab on a piece of white hot glass. The way to do this is to fuse up in the blowpipe a bead on the end of a fiber. The smaller and hotter it is, the better chance of a square crack. This is the method to use when only a ragged corner or a short end has to come off. If there is an electric current handy, the largest tubes may be cut with certainty. Just where the scratch has been made wind one turn of wire—platinum is the best—of such length and diameter as to get white hot when the current passes through it. The ends where the wire leaves the glass should be as close as possible, but must not touch so as to short circuit. The part round the glass keeps much cooler than the other, but the current may be switched on and off, so as to have it red hot without overheating the free part.

Another method for large tubes, but one not generally so successful, is this: About one-half inch on each side of the scratch wrap strips of wet blotting or filter paper, and then turn the bare part in front of a sharp pointed flame. If the crack starts well, it may be led round by the flame. One of the most important factors of success in all these methods is the scratch, which can best be done with a knife, generally a rectangular piece of good steel hardened in salt water and sharpened. It is best not to scrape the knife against the glass, but to turn the latter while resting in a notch in the tube against some ridge in the knife, which is pressed firmly against the tube.

Treatment of Diphtheria by the Bichloride of Mercury.

Dr. E. L. Oatman, of Nyack, writes that for the past two years he has treated diphtheria by the local use of a solution of the mercuric bichloride, and has been greatly pleased with the results obtained. "Iron in large doses and free stimulation certainly play an important part in the treatment; but with these alone I lost—at St. Agatha's Asylum—ten out of twenty-three cases, while since the addition of local treatment by the mercuric solution, I have lost but one out of thirty-four subsequent cases. This patient died two weeks after the subsidence of all local symptoms, from paralysis of the muscles of respiration. Seven of my cases have had more or less paralysis of the muscles of deglutition during convalescence. This appears to be a large percentage, and might direct some suspicion toward the mercury as being in a measure causative. The details of treatment in an ordinary case, and as followed in the hospital ward, are as follows: I manufacture on the spot about fifty swabs—made by twisting absorbent cotton around a stick about the size of a lead pencil. The cotton should be pulled out and twisted firmly around the tip of the stick, extending beyond it, that the end may be thoroughly protected, so that no injury be done while using it. This is dipped in a solution of the bichloride of mercury, two grains to one pint of water, and is passed into the throat until it touches the posterior wall of the pharynx. It is then instantly withdrawn and burnt. No swab should ever be used a second time. No attempts are made to rub off any of the membrane, but more or less always adheres to the swab. This procedure is repeated hourly, day and night, until the disease begins to subside—which it usually does in forty-eight hours. I follow every application by the internal administration of five to ten minims of tincture of the chloride of iron, and as much whisky and milk as the case appears to demand. If the interior or posterior nares are invaded, the nose should be syringed. The conical urethral syringe is the safest instrument to leave in the hands of a non-professional nurse. It is of the first importance that the nurse or mother be fully instructed in the method of treatment, and should make the application satisfactorily to the physician before being left in charge of the patient. In no case have I ever experienced any difficulty in getting my instructions carried out, or met with any serious resistance from the patient.

"Spraying the throat is a far more difficult procedure for the lay attendant, as the tongue obstructs the pas-

sage, while none of the loose membrane and mucus is removed as with the swab, but is swallowed, and systematic infection furthered. The diphtheritic membrane cannot flourish in contact with the bichloride of mercury, and if this invaluable agent be constantly applied to the diseased surface for a few hours, the poison will be destroyed. I attach great importance to the method of application, and the extraction of the loosened membrane, beneath which the poison is still active, but inaccessible to the antiseptic."—*Medical Record.*

In Slumber for Five Years.

An extraordinary case of suspended animation is reported from Thenelles, a town in France. The subject is a young woman, twenty-five years of age, and since the 20th of May, 1883, she has been continuously in a state of deep sleep. She has been examined by physicians and specialists a number of times, and recently by a select committee, and from their observations it was learned that her sleep resembled a lethargic torpor, in which her respiration was normal, and her pulse, although feeble, was found to be rapid—about 100 pulsations a minute.

Every attempt to arouse her from her stupor has proved unsuccessful, and the senses appear closed to every influence. Sounds, pinching, blows, piercing the body with a needle, alike have no effect. The eyes are cast upward so far that it is not possible to examine the pupil, nor is any reflex movement of the eyelids noticeable when the eyeballs are blown upon. The jaws are firmly set, and several of the teeth of the subject have been broken in ignorant attempts to force them apart.

The subject was in a very delicate state of health before falling into the lethargy, and was of a nervous, highly strung temperament, and was thrown into a series of convulsions by a sudden fright, which was followed by the deep sleep from which she has never been aroused. It is possible to feed her with liquids, administered with a spoon, and this is done several times a day, the food consisting usually of milk, and milk with the white of egg, sirup and other liquids. The fluid is poured into the mouth and thence it flows into the pharynx, when a swallowing movement may be observed.

The *Revue de l'Hypnotism*, which has a long article concerning this case, considers the patient an hysterical epileptic, thrown into a condition resembling that period of hypnotism which is designated lethargic sleep. It is probable that life will continue for some time longer, provided the digestive processes continue uninterrupted, although death usually marks the end of these long periods of inanition.

Several Things Worth Knowing.

A drilled well should be made deep, that it may hold considerable water. If not, it may too easily be pumped dry. Moreover, the fine sand generally present works its way, not only filling up the lower end of the casing, but when the pump pipe is set low, and is pumping fast, some of the fine sand will be pumped up and lodge in the valve, soon causing the valve to stay partly open, so that the pump will not hold water, but must be primed for a new start. If the well be drilled deep after it is first reached, a space can be allowed for filling up, and the pump pipe need not be placed so near the bottom. But there is less danger of filling up if the well be thoroughly cleaned or pumped out after being sunk to the proper depth. This work, says the *Industrial Gazette*, properly belongs to the men who drill the well, and should never be omitted. A great deal of floating sediment, if not removed then and there, will be a source of trouble ever afterward.

More bridge work is projected at this date than ever in the history of the country. Two are projected across the Hudson, six across the Mississippi, two across the Missouri, a $10,000,000 bridge across the Potomac, 4,660 feet long, besides a multitude of smaller bridges. The bridge works are constantly overrun with work, and bridge iron makers are unable to accept all the business offered. Four bridge building works are projected, and an expansion of mill capacity is going on.

It is reported from Baku that a gigantic oil spring burst forth there on the 23d of March, carrying up oil, sand, and large stones to a height of 350 feet. It overran several reservoirs prepared for it, and, after forming an extensive petroleum lake, forced its way into the sea.

Dr. Vulpian has communicated to the Paris Academy of Sciences the result of some experiments of inoculation against yellow fever, which have been made at Rio Janeiro in the epidemic lately prevailing there. Of 6,524 persons thus treated, only six died, or one per thousand; while the proportion of deaths among inhabitants not inoculated was one per cent. Two Brazilian doctors are about to proceed to Panama to apply the treatment to workers on the isthmus, among whom the mortality is said to be very great.

The Smithsonian Institution has received from Col. J. H. Wood, of St. Paul, the bodies of five persons—a man, woman, and three children—taken from a cave in the Bad Lands of Dakota by a miner. The bodies are simply dried up, and are not petrified, but are in a remarkable state of preservation. Scientific men who have seen them say they belong to a race which existed two thousand years ago.

Reports of the devastation and loss of life by the recent cyclones in Kansas, Missouri, and Arkansas are heartrending, and the number of lives lost is much greater than was at first anticipated, and would have been much greater had not many provided dugouts, in which they concealed themselves till danger was over.

It is admitted by most workmen that the best method of tempering many kinds of tools, especially drills, is to force the implement when at a cherry red heat into a bar of lead.

The ARCHITECTS AND BUILDERS edition of the SCIENTIFIC AMERICAN has, since the publication was commenced—eighteen months ago—met with phenomenal success, having acquired, in so short a time, a circulation unprecedented by any publication of its class.

In a recent case decided between architect and client at Albany, the client having notified the architect to stop work after he had ordered specifications, details, and estimates to be prepared on designs accepted by him, the client was compelled to pay three and a half per cent on the amount the building was to cost. The referee based this on one per cent for the sketches and two and a half per cent for working plans, specifications and details, and obtaining estimates. The architect sent in a bill for $550, and the sum awarded him was $417.50 for his trouble, expense, and work.

The following recipe for keeping moths out of clothing is a favorite in some families: Mix half a pint of alcohol, the same quantity of spirits of turpentine, and two ounces of camphor. Keep in a stone bottle, and shake before using. The clothes or furs are to be wrapped in linen, and crumpled up pieces of blotting paper dipped in the liquid are to be placed in a box with them.

In boring an artesian well at Eureka, Cal., charred wood was found at 500 feet, and pieces of shell and parts of the skeleton of a bird at 580 feet.

THE PARIS EXHIBITION.—The next International Exhibition, to be held in Paris, in 1889, like that of 1878, is to be adorned with a captive balloon. It is to be of enormous size; and, as in 1878, the maximum altitude reached will be about three thousand two hundred and fifty feet. An engine of six hundred horse power will be employed to pull the enormous mass back to Mother Earth. It will be remembered that the balloon of 1878 was torn to pieces in a high wind, owing to the fact that it was not kept full of gas. In the new balloon a special precaution is to be taken to preserve the tightness of the envelope, so that the wind can find in it no hollow or wrinkle. A smaller balloon, filled with atmospheric air, is to be placed inside the large one, and the volume of this smaller balloon can be increased or diminished by means of an air pump worked by an electric engine in the car. By this means variations of temperature, with the consequent alteration of bulk in the gas, can be compensated for.

An Easy Way to Prevent Loss of Apples.

To determine its value as an insecticide, arsenic in solution was compared with Paris green. The arsenic solution was made by boiling one ounce of arsenic in one quart of water, and adding this solution to 20 gals. of cold water. The Paris green mixture consisted of three-fourths of an ounce of this substance (containing 15·4 per cent metallic arsenic) stirred in two and one-half gals. water. A fine, mist-like spray of the liquid was applied until the leaves began to drip. The number of apples examined on eight trees, two of which were sprayed with the arsenic solution and six with Paris green, up to Oct. 4, was 38,688. Eight untreated trees were used as checks. During 1885 Paris green was also used as noted above, and 69 per cent of the fruit which would otherwise have been sacrificed to the codling moth was saved. In the 1886 experiments, 78 per cent was saved from falling by a single spraying, 77 per cent by two, and about 72 per cent by three sprayings. The benefit to the picked fruit apparent from a single spraying was placed at 47 per cent, from two 90 per cent, and three at 77 per cent, or as summarized, spraying in early spring, before the young apples had drooped upon their stems, saved 75 per cent of the apples exposed to injury from codling moth. The weather conditions prevailing shortly after the poison is applied will have much to do with its efficacy. The best results from the application of Paris green were secured upon the appearance of the first brood. Experimental facts point to inefficiency as applied to later broods. It is not recommended to poison full grown apples. In fact, spraying after the apples have begun to hang downward is unquestionably dangerous, and should *never* be done if the fruit is to be used. In comparing arsenic with Paris green, the experiments show a decided advantage in favor of the latter. Trees sprayed with arsenic scorched the leaves, while Paris green produced no injurious effects. Prof. Forbes finally concludes that at least 70 per cent of the loss commonly suffered by the fruit grower from the codling moth may be prevented at a nominal expense, by thoroughly applying Paris green in a spray with water, once or twice in early spring, as soon as the fruit is fairly set.—*S. A. Forbes, Bull. 4., State Ento. of Ill.*, 1887.

The Living Earth.

As another illustration of the life that dwells in nature, let us briefly consider earthquakes. The peculiar terror of an earthquake lies mainly in the suddenness of its approach. Volcanic eruptions are usually preceded by vast rumblings, or jets of steam, or other unmistakeable tokens. Hurricanes and cyclones in like manner have heralds that announce their coming. But with an earthquake there are no premonitory symptoms. The great earthquake which took place at Lisbon in the year 1755 found the people engaged in their ordinary occupations. All the shocks were over in about five minutes. The first shock lasted about six seconds. In that brief space of time most of the houses had been thrown down and thousands of men, women, and children crushed beneath the ruins. At times the ocean lends fresh terrors to the scene. Thus at Lisbon a wave of water over fifty feet high rushed in among the houses, and covered what still remained. In the island of Jamaica on a different occasion two thousand five hundred houses were buried in three minutes under thirty feet of water. Recent delicate scientific experiments have discovered the fact that the surface of the land is never absolutely at rest for more than thirty hours at a time. Thus those great earthquakes which make epochs in history are merely extreme cases of forces that seldom sleep.—Extract from a lecture by A. Ewbank in *Indian Engineer*, published in Calcutta.

The Size of Ocean Steamships.

The following table gives the name, date of construction, tonnage, length, breadth, and depth of the principal steamships plying between European and American shores:

Name.	Built.	Gross tonnage.	Length.	Beam.	Depth.
City of Rome	1881	8,144	546	52	37
Umbria	1884	7,800	500	57·2	38·1
Etruria	1884	7,718	501·6	57·2	38
Servia	1881	7,392	515	52·1	37
Aurania	1882	7,269	470	57·2	37·2
Le Bretagne	1886	7,012	508·4	52·4	38·4
La Bourgogne	1886	7,000	508·6	52·2	38·8
La Champagne	1886	7,005	508·7	51 6	38·4
La Gascogne	1886	7,008	508·7	52·2	38·3
Alaska	1881	6,932	500	50·6	38
America	1883	6,500	432	51·3	35·8
Normandie	1882	6,062	459	50	37
Westernland	1883	5,736	455	47	35
Saale	1886	5,500	455	48	38
Trave	1886	5,500	455	48	38
Aller	1886	5,500	455	48	38
City of Berlin	1874	5,491	488·6	44·2	34·9
Noordland	1883	5,212	400·7	47	35·3
City of Chicago	1883	5,202	430	45	33·6
Eider	1883	5,200	450	47	33·6
Arizona	1879	5,147	464	46	37
Ems	1884	5,129	430·5	47	34·5
Fulda	1883	5,109	450	46	36
Werra	1882	5,100	450	46	36
Belgravia	1881	5,080	398·2	44·5	32·2
Germanic	1874	5,008	455	45·2	33·7
Britannic	1874	5,004	455	45·2	33·7
Elbe	1881	4,911	420	45	36·5
England	1865	4,898	437	42·5	35
Egyptian Monarch	1880	4,709	370	44	35·8
Egypt	1871	4,610	440	44·3	36 5
France (Fr.)	1865	4,647	384	44	36
Amerique	1864	4,637	394	42·0	36·9
City of Richmond	1873	4,607	452·6	43	36
Erin	1864	4,500	415	41	35
City of Chester	1873	4,565	475	44·3	35
Spain	1871	4,512	425·4	43·2	36·2
City of Montreal	1871	4,451	419·1	44	34·3
The Queen	1865	4,457	381·1	42·4	37·3
Grecian Monarch	1882	4,364	381	[illegible]	33
Greece	1863	4,310	390·7	41·3	35·3
Devonia	1877	4,269	400	42	32
Hammonia	1882	4,247	375	45	34
Italy	1870	4,169	389	42·3	38 7
Anchoria	1874	4,168	480	40·1	33·8
State of Nebraska	1880	4,000	385	43	34
Ethiopia	1873	4,005	402	40·2	33
Lydian Monarch	1881	3,916	360	43	32·4
Adriatic	1871	3,888	437·2	40·9	31
Celtic	1872	3,867	437·2	40·9	31
Denmark	1865	3,724	342·9	42 2	36
Republic	1871	3,707	420	40·9	31
Baltic	1871	3,707	420	40·9	31
Suevia	1874	3,704	360	41	34
Wisconsin	1870	3,700	378	43·2	32

Other well known ships are the France, State of Nevada, State of Pennsylvania, Monarch, Rhynland, Abyssinia, Australia, Lessing, Wyoming, Rugia, Belgenland, Wieland, State of Alabama, Westphalia, Pennland, Zeeland, Assyrian Monarch, State of Georgia, Bohemia, State of Indiana, Acadia, Nederland, Alexandria, and Assyria. These register from 3,600 to 1,082 tons. The Acadia is the smallest.—*The Engineer.*

Sheep.

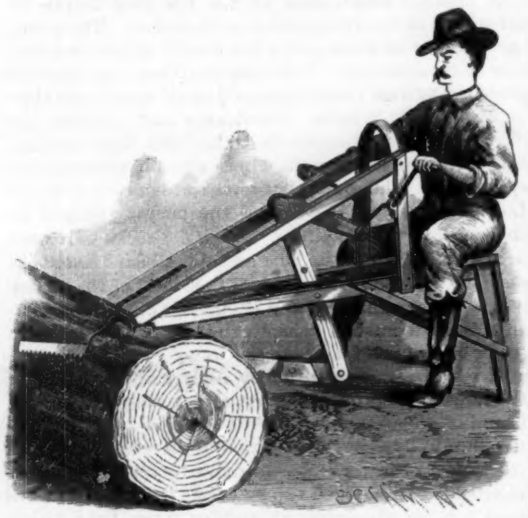
The number of sheep in the world is estimated as follows, according to the latest statistics:

South America	100,000,000
Australasia, including New Zealand	77,000,000
Europe	212,000,000
Africa	25,000,000
Asia	50,000,000
United States	45,000,000
Canada	3,000,000
All other countries	5,000,000
Total	517,000,000

In the United States the average yield of wool is about six pounds per head.

IMPROVED DRAG SAW.

The simple drag saw here illustrated is the invention of Messrs. Mervin and George E. Coxe, of Great Valley, N. Y. The rear end of the bed frame is supported by legs. On the frame are standards, connected by inclined braces with the front of the frame. The front ends of these braces support a guide formed with a



COXE'S IMPROVED DRAG SAW.

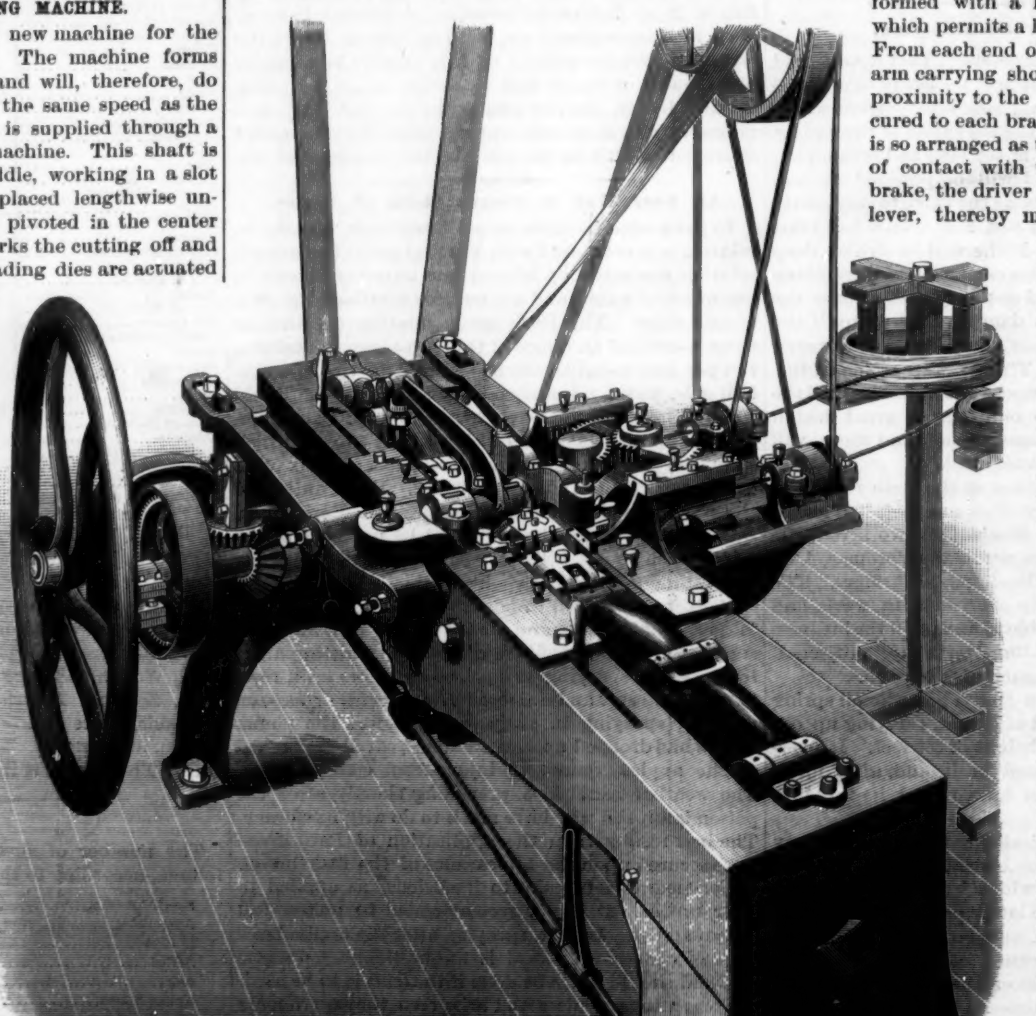
longitudinal slot, and to the under side of the ends of the braces are secured pointed spikes or clamps. The upper ends of the standards are united by a curved brace. On the side edges of the two beams of the frame are held metallic guide plates, through which and through the beams passes a shaft, on which oscillates a lever, connected at its upper end by a link with a crank shaft journaled in the standards and provided at each end with a handle. The lower end of the lever is pivotally attached to the holder carrying the saw blade. The machine is placed in position, as shown in the engraving, and the spikes are firmly embedded in the log, with the saw resting in the slot of the guide. The frame is thus held in a horizontal position at one end by the log and at the other by its legs. The operator seats himself on a platform on the rear end of the frame, and by turning the handles imparts a forward and backward motion to the saw. The pivotal connection of the saw holder with the lever permits the saw to adjust itself to the cut in the log. The throw of the lever can be increased or diminished by placing the pin on which it is fulcrumed in any one of the holes formed in the lever.

LOVELL'S NAIL MAKING MACHINE.

Our engraving represents a new machine for the manufacture of French nails. The machine forms four nails at each revolution, and will, therefore, do four times the work if run at the same speed as the older type of machine. Power is supplied through a lay shaft at one end of the machine. This shaft is provided with a crank in its middle, working in a slot at the end of a balance lever placed lengthwise underneath the main frame, and pivoted in the center of the machine. This lever works the cutting off and the pointing dies, while the heading dies are actuated by two other levers with vertical pivots, worked from vertical shafts geared by bevel wheels to the lay shaft. The slot in the bottom lever is slightly wider than the head of the crank, so as to produce a short pause at either extremity of its oscillation, and give the heading lever time to form the head before the nail is released.

The wire which is to be worked up into nails is placed in coils on two wooden reels, free to revolve on vertical spindles, and passes first through two revolving wire straighteners, which receive rotary motion by belts from the overhead shaft, and, at the same time, a horizontal to and fro motion by the heading lever on that side. This horizontal motion prevents them cutting the wire during those intervals when the wire is at rest. The linear speed of the straighteners is half that of the forward motion of the wire, and since each straightener in turn moves outward when the wire is at rest, and inward when the wire travels, the relative speed of wire and straightener is maintained, both on the outward and inward stroke; in other words, each inch of wire passing through the straightener is operated upon by the revolving dies to the same amount. After passing the straightener, the wire is led through a stationary clip, which allows it to travel forward, but prevents it being drawn back by the action of the straightener. It then passes through another clip, acting in the same direction, but connected with the heading lever by toothed racks and segments in such a way as to draw forward at each stroke the length of wire requisite for the formation of two nails. After this amount of wire is pushed into position in a slot formed in the central block shown in our illustration, it is separated by a cutting die, worked from the rocking lever below the frame, and the short piece left is gripped by two fingers and drawn down into another slot, where the operation of forming the double nail actually takes place. The points are formed by the pressure of pointing dies worked from the rocking lever by means of a knee joint. One of the dies is stationary, being fixed in the block and placed in the center of the slot above referred to, while the other is fixed to a crosshead sliding between the frames, and receiving to and fro motion from the knee joint. There is a slight pause after each stroke, as already explained.

The dies are cylinders of steel, with triangular and tapering slots in their end faces, so that when they are closed up there is left on each side of the center a pyramidical cavity corresponding to the point of the nail. The material squeezed away from the wire flows laterally, that is, in this case, vertically upward and downward, forming a barb, which either falls off before the nail is released, or is easily removed afterward in the process of cleaning the nails in revolving barrels. The crossheads, carrying the pointing dies, are provided with steel faces, and when the knee joint is straight, they gripe the wire firmly, so as to prevent it shifting longitudinally under the pressure of the heading dies, which next come into play. As soon as the heading die recedes, the knee joint is lifted, the crosshead is withdrawn, and the two nails fall out, while a new length of wire is drawn down into the slot to undergo the same process. During the time that the wire is fed into the machine on one side of the central block, two nails are formed on the other, and so the operation is kept up alternately, the total number of nails produced per minute equaling four times the number of revolutions made by the lay shaft per minute. According to the size of machine, the speed varies from three hundred revolutions to one hundred revolutions, and the number of nails from twelve hundred to four hundred per minute. These are the limits given for nails which vary in size from 1 in. long, No. 17 B. W. G., to 5 in. long, No. 5 B. W. G. We have been favored by Herr A. Fix, a nail maker in Germany, with the following figures relating to the performance of the German and French machines employed by him:



IMPROVED NAIL MAKING MACHINE.

OLD TYPE MACHINES OF FRENCH MAKE.

Length of nail. Inch.	Gauge of wire. B. W. G.	Nails produced per minute.
¼ to 1	26 to 18	285
½ " 2	17 " 12	230
⅝ " 3½	13 " 10	150
¾ " 4¾	8 " 4	100
2 " 8	6 " 00	70

OLD TYPE MACHINES OF GERMAN MAKE.

Length of nail. Inch.	Gauge of wire. B. W. G.	Nails produced per minute.
2¾	16 to 12	160
4	13 " 10	130
5	12 " 7	110
8	7 " 2	85
12	2 " 00	45

There are some recent improvements made in German machines which enable these to turn out 25 per cent more than is given in the above table; but even when taking these improvements into account, it will be seen that if we consider the figures given by Herr Fix as fair averages for the usual practice in the manufacture of French nails, the Lovell machine is a very decided improvement upon machines hitherto employed in that industry.—*Industries.*

IMPROVED VEHICLE BRAKE.

In the forward part of the bottom of the wagon body is a slot through which projects a foot lever pivoted to

IRWIN'S IMPROVED VEHICLE BRAKE.

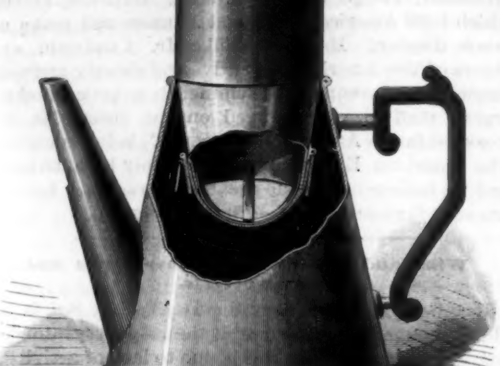
the body. The lower end of the lever extends a short distance below the bottom, and is pivoted to a horizontal rod which extends toward the rear, and rigidly joins a vertical arm secured to a transverse rod held in brackets on each side of the box. Each bracket is formed with a horizontal elongated slot, which permits a lateral motion of the rod. From each end of the rod extends a brake arm carrying shoes which are held in close proximity to the rear wheels. A step is secured to each brake arm, and a push spring is so arranged as to hold the brake shoes out of contact with the wheels. To apply the brake, the driver presses his foot against the lever, thereby moving the transverse rod toward the rear, and bringing the shoes against the wheels. This movement compresses the spring, which forces the shoes away from the wheels when the lever is released. It will be seen that the entire construction of this brake is very simple, as only the two brackets are used to support the rod and its brake arms.

This invention has been patented by Mr. John H. Irwin, of 2105 Walnut Street, Philadelphia, Pa.

THE crystals of spodumene brought to view by the excavations in the Etta tin mine in Pennington County, Dakota, are believed to be without a rival in respect to size. According to the report made on this subject by Professor Blake, it appears that one of these crystals is thirty-six feet in length in a straight line, and from one to three feet in thickness. The cleavage is smooth and straight, but the lateral and terminal planes are described as being obscure.

IMPROVED COFFEE POT.

In this pot the coffee is made by the percolation of hot water through the ground coffee. To the cylindrical portion of the percolator is secured a conical part, which fits into the top of the ordinary coffee pot in place of the usual cover. To the smaller end of the conical portion is fitted a ring, hinged at one side, and the wired upper edge of which engages, when the ring is closed over the end, with a raised ridge on the opposite side of the conical part. A piece of cloth is placed over a basket formed by two downwardly convex bars secured to the lower end of the cone, and the hinged ring is then closed in place over the end. The ground coffee is placed in the basket, where it is supported by the cloth, and the coffee is extracted by pouring hot water through it, the extract being received in the coffee pot. When the cloth becomes clogged or otherwise unfit for use, it may be readily detached by removing the ring.



CORNISH & MOORE'S IMPROVED COFFEE POT.

This invention has been patented by Messrs. H. B. Cornish and J. B. Moore, of Blue Earth City, Minn.

IMPROVED OILER.

The accompanying engraving represents a new and improved oiler possessing many excellent points. When the handle is grasped by the hand, the broadened end of a lever is within convenient reach of the thumb. The opposite end of this lever, which is fulcrumed on a standard projecting from the top or cover of the can, is pivotally connected with a rod passing through a stuffing box, and carrying at its lower end a plunger that works in a cylinder extending nearly to the bottom of the can. In the lower end of the cylinder and in the plunger are valves, both of which open upward. The plunger is pressed downward by a spring encircling its rod. From the top of the cylinder leads the spout. The top screws into the body of the can, which is fitted through an opening in the top, closed by a screw cap. As the lever is worked by the thumb, the oil is forced by the pump out through the spout. It is evident that from this construction the oil can be thrown from the oiler when held in any position, thus enabling the operator to oil machinery overhead, near walls, posts, floors, etc., at any point that can be reached by the spout. No wasting of oil can occur, as the spiral spring forces the piston firmly down upon the lower valve, thereby making the cylinder air tight, and preventing the flow of oil. By controlling the pressure of the thumb upon the lever, the flow of the oil from the spout can be easily regulated to meet the requirements of the parts being oiled. These oilers are made in steel and brass, and one style, which is practically indestructible, is especially adapted to the use of locomotive engineers. A sample oiler can be had by addressing the Draper Oiler Co., of East Cambridge, Mass.

This oiler is the invention of Messrs. T. B. Wilkinson and J. L. Cutler, whose address is care of Draper Oil Co., as above.

Metallic Cement.

The *Chemist and Druggist* (London) tells us that the cement which was used in the restoration of the colonnade of the Louvre, of the Pont Neuf, and of the Conservatoire des Arts et Metiers, consisted of a powder and a liquid, prepared according to the following formulæ:

1. Two parts by weight of oxide of zinc, two of crushed limestone of a hard nature, and one of crushed grit, the whole intimately mixed and ground. Ocher in suitable proportions is added as a coloring matter.

2. A saturated solution of zinc in commercial hydrochloric acid, to which is added a part, by weight, of hydrochlorate of ammonia equal to one-sixth that of the dissolved zinc. This liquid is diluted with two-thirds of its bulk of water.

To use the cement, 1 pound of the powder is to be mixed with 2½ pints of the liquid. The cement hardens very quickly, and is very strong.

Deterioration of the Mental Faculties.

There is as much danger of hurting the brain by idleness as by overwork. According to a writer in *Faith and Work*, Dr. Farquharson argues that intellectual power is lessened by the listlessness in which the well-to-do classes generally spend their lives. Under such conditions, the brain gradually loses its health, and although equal to the demands of a routine existence, is unable to withstand the strain of sudden emergency. So, when a load of work is unexpectedly thrown on it in its unprepared state, the worst consequences of what may be called overwork show themselves. Similarly, a man accustomed to sedentary pursuits is liable to be physically injured by taking suddenly too violent exercise.

As to the amount of mental work that may safely be done, Dr. Farquharson says: "So long as a brain worker is able to sleep well, to eat well, and to take a fair proportion of out-door exercise, it may safely be said that it is not necessary to impose any special limits on the actual number of hours which he devotes to his labors. But when what is generally known as worry steps in to complicate matters, when cares connected with family arrangements, or with those numerous personal details which we can seldom escape, intervene, or when the daily occupation of life is in itself a fertile source of anxiety, then we find one or other of these three safeguards broken down."

FRICTION CLUTCH PULLEY.

In this friction clutch pulley the clamping and clutching devices, which cause the pulley to revolve with the shaft, are detached from the shaft when the pulley is stopped, and the shaft then revolves in the clutching devices as well as in the pulley. The pulley is loosely mounted upon the shaft, and is formed with an elongated hub. A drum, secured to the shaft and projecting over one end of the hub, is surrounded by a split band, each half of which is connected with the web of the pulley by a bolt extending through a short radial slot in the web. Each half of the band has ears, which are apertured to receive nuts (shown in the small view), which are clamped in the apertures by set screws, the nut in the ears of adjoining ends of the band being threaded, one with a right hand and the other with a left hand thread, and in the nuts are placed right and left hand screws. To these screws are secured curved levers, which are connected by rods with a sliding collar placed on the hub. The collar is circumferentially grooved to receive the forked arm by which it is moved on the hub. When the collar is moved toward the split band the screws are turned, through the action of the connecting rods and levers, in the direction required to draw together the split band upon the drum; and as the latter revolves continually with the shaft, when the band is tightened down upon the drum it will revolve with the drum and carry the pulley with it. When it is desired to stop the pulley the collar is moved backward, thereby turning the screws to release the band from the drum, when the pulley and clutching parts will remain stationary.

This invention has been patented by Mr. James E. Hunter, of North Adams, Mass.

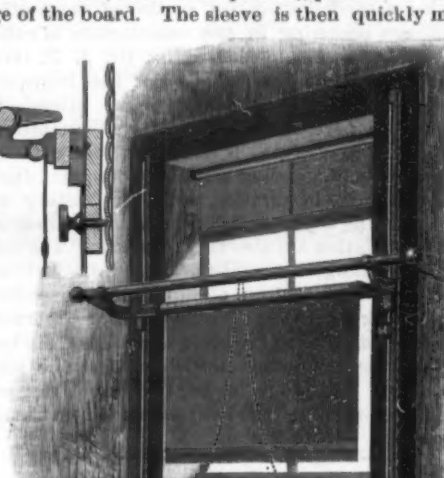
HUNTER'S FRICTION CLUTCH PULLEY.

A SIMPLE FLOOR CLAMP.

This new and improved clamp is for pressing floor boards in place. On opposite sides of the end of a bar of suitable size are pivoted two gripping levers, shaped as shown in the engraving. The upper arms of the levers fit in holes formed in a plate secured to the lower end of a sleeve adapted to slide on the bar. The upper ends of the arms are formed with lugs, to prevent the plate from being removed. In lugs formed on the end of the rod is pivoted, at right angles to the gripping levers, an arm carrying the pressing plate, provided at its middle with an inward bend, and with transverse grooves running from the outer ends to the bend, and conforming to the shape of the tongues of the boards, as shown in the upper figure. The hooks of the levers are opened by sliding the sleeve carrying the plate upward on the bar, when the tool is placed in position on the floor beam, so that the pressing plate rests on the edge of the board. The sleeve is then quickly moved downward to cause the hooks of the levers to close and impinge on the joist. The bar is then swung toward the floor boards, the fulcrum being the hooks on the joist, so as to press the floor board into place.

GOOD'S SIMPLE FLOOR CLAMP.

This invention has been patented by Mr. Milton D. Good, of Hope, Dickinson County, Kan.



HATCHER'S ADJUSTABLE LAMBREQUIN, CURTAIN, AND SHADE SUPPORT.

ADJUSTABLE LAMBREQUIN, CURTAIN, AND SHADE SUPPORT.

Attached to the casing at each side of the window is a tubular metallic column, formed with corrugations upon the side next the window. Sliding within the columns are short metal rods, having near their lower ends apertures into which set screws are entered to a bearing upon the corrugations, as shown in the sectional view. The upper ends of the rods are secured to a transverse bar, which may, if necessary, extend the width of the window casing. Secured to the ends of this bar are brackets, in the concaved outer ends of which rests a lambrequin pole having rearwardly extending arms at each end. Within the casing, next the window, is the usual automatic spring roller and curtain. To the transverse bar are attached any suitable curtain brackets, hanging in which is a curtain, and above the whole, upon the pole, is placed a lambrequin which extends around at the sides over the end arms. It will be seen that the sliding rods have a free parallel vertical movement in the tubes, and through this movement the transverse bar and brackets and the curtain and lambrequin attached to them may be either raised or lowered. The admission of light to the room is thus under complete control.

This invention has been patented by Mr. J. A. Hatcher, of Neodesha, Kansas.

The Hygiene of Occupations.

The hygiene of occupations has been attracting the attention of the State Board of Health of New Jersey, who have as a preliminary to the study set forth the general considerations involved in a paper by Dr. E. M. Hunt. He is followed by Dr. J. W. Stickler, who, after having dealt in detail with the various processes included in hat making, finds that from the beginning, when the different furs are dealt with in the mixing and blowing room, to the end, when the finishers take up the manufacture, certain diseases, and especially affections of the respiratory organs, are liable to be induced. In fact, out of a total number of 722 hatters, the cause of whose death could be accurately determined, no less than 51·8 per cent died of pulmonary phthisis, and 63·5 per cent of some form of lung lesion. The next subject of work is that of silk, flax, and jute, which is taken up by Dr. W. K. Newton. As regards silk, he would strongly discourage weaving in dwelling houses, where the loom or reel is often set up in an already overcrowded kitchen or living room; but he holds that if factories could be built and maintained so as to afford proper lighting, heating, and ventilation, the silk manufacture ought to be a healthful one. In the case of flax and jute, the hackling process, for which no satisfactory machine has been invented, fills the air with dust made up of dirt and minute fibers, leading to paroxysms of coughing and often to early death. The spinning process charges the air in much the same way, the hair and clothing of the operatives being covered with the dust. Hemp and flax dressers inhale a dust that is peculiarly irritating, and the processes generally tend to destruction of the lung tissues in some form or other, and lead to a high mortality among the workers. Fans are stated but rarely to effect a proper change in the state of the air, and hence some form of air filter over the mouth is recommended. In wet spinning, the air, instead of containing dust, is loaded with moisture, which drops like a fine mist on the operatives, who are practically subjected to a vapor bath—an arrangement provocative of bronchial and other catarrhal affections, as also of rheumatism. The diseases occurring in the manufacture of rubber boots and shoes are considered by Dr. J. P. Davis. After a description of the processes of this trade, it is pointed out that the greatest danger attends the compounding process, in which a large quantity of white lead, litharge, etc., is mixed with the rubber or gum, lead poisoning being especially frequent during moist hot seasons in summer, when the factory windows have to be kept carefully closed. The heat and want of ventilation are also very injurious. The other conditions leading to mischief are the introduction of naphtha into the caldron of liquid; the machinery, with resulting accidents; and the fixing of the rubber when completed on to the heels and soles of the boots and shoes, the last being pressed against the pit of the stomach. It is to be hoped that the series commenced in this report will be extended to other trades. —*Lancet.*

The Best Evergreen Barberries.

Now that the planting season for evergreens is at hand, it may be well to direct attention to the best kinds of barberry to plant, as they are so indispensable in every shubbery. Of the many species of Berberis in cultivation, which number over half a hundred, only about half a dozen among them are what may be termed really handsome shrubs; and although they differ widely in structural peculiarities, many of them possess a striking resemblance to each other. The genus is divided into two sections, the Berberis proper and the Mahonia, which sometimes ranks as a distinct genus. Among the true barberries a few are really beautiful shrubs. The finest, no doubt, is B. darwini, first discovered by the late Mr. Charles Darwin in Chili, and than which no more beautiful hardy shrub exists. This species is now too well known to need description. This year it has been very beautiful, the winter having been favorable to it, though even this season it has not been so fine as it was in the spring previous to the two disastrous winters of 1879 and 1880, which crippled it severely. Being a native of Chili, it will not stand any great degree of cold, and it is all the better for a mild spring. Next to Darwin's barberry in point of beauty is B. stenophylla, a garden hybrid between B. darwini and B. empetrifolia. The long slender branches of this barberry droop gracefully on all sides, making the bush, when profusely laden with blossoms, look like a fountain of molten gold. It is, moreover, a shrub that is not at all fastidious as to position, for it grows in shade as well as exposed, but it flowers most freely when in a good light soil in a warm, sunny situation. It is much hardier than B. darwini, and seldom suffers from severe frosts. B. empetrifolia, though a fine shrub, is not equal to either of the preceding in point of floral beauty, but its habit of growth is elegant and it is very hardy. B. dulcis and buxifolia need only be grown where a variety of barberries is required. Of the Mahonia section, the commonest and most useful is, of course, B. aquifolium, perhaps the most beautiful of all evergreen shrubs. As it is, or ought to be, in every garden, there is no need to describe it. Similar to it, but different in foliage and dwarfer in growth, is B. repens, which makes a capital margin to larger groups. Less common kinds are B. glumacea and fascicularis, but they are not so desirable as B. aquifolium. Even without reckoning the many varieties of the Mahonia section which are more or less rare, there is quite a wealth of beauty in the evergreen barberries alone, and they can be obtained cheaply in nurseries.—*W. G., The Garden.*

A CONVENIENT ESCRITOIRE.

This convenient case is designed to hold various articles of stationery for individual use, both when at home and when traveling. The receptacle contains every requisite for correspondence, and the arrangement is such that each article can be seen at a glance and readily secured. The interior is specially fitted and adapted to hold particular articles of stationery, which will be retained in position, no matter how the case, when closed, may be thrown or handled. The case is small, so that, when traveling, but little space is required in the trunk or valise. The exterior of the bottom is made smooth, to form a writing surface when the case is inverted, and held on the arm or lap. The annex box, which is shown open d, is placed within the main receptacle, and contains a screw cap inkstand, seal stamp, sealing wax, tapers and pens.

ANNEX BOX.

OPEN.

CLOSED.

THE BON-TON ESCRITOIRE.

This useful article is the invention of Mr. J. F. Tannatt, of Springfield, Mass., to whom all inquiries should be addressed.

SMALL DYNAMO ELECTRIC MACHINE.

It is gratifying to learn, by letter and otherwise, that the description of the small dynamo given in SCIENTIFIC AMERICAN SUPPLEMENT, No. 161, has enabled many of our amateur electricians to make successful machines; and we are pleased to know that one of our enterprising firms has undertaken to supply something that has been wanted since the SUPPLEMENT above referred to was published, namely, the parts of the dynamo.

Messrs. Goodnow & Wightman, of 176 Washington Street, Boston, Mass., in response to many inquiries, have made patterns and produced castings of the field magnet, the armature, wheel, pulley, crank, etc., which they have placed at reasonable prices. They are willing to furnish the parts either separately or all together, and will finish any parts as may be desired. We present herewith an engraving of the dynamo referred to.

HAND POWER DYNAMO.

The American Exhibition, London.

During the last fortnight, remarkable progress has been made with this novel and extensive undertaking, and despite the short time that now remains before the opening, we think there is little doubt the work will be at least as near completion as any exhibition ever attains on the day it is thrown open to the public. Next week Mr. Smith, the chief of installation, will be ready to receive exhibits, and from his great experience at Philadelphia, Paris, and elsewhere, there is little doubt that the tedious and thankless task of arranging exhibits and satisfying exhibitors will be well accomplished. The large hall now shows its noble proportions, which adapt it admirably for the purpose, and the general effect from the entrance will, we think, be far more striking than the view from the grand vestibule of the South Kensington Exhibition. The other structures, as well as the extensive grounds, are making rapid strides toward completion, the stabling, corrals, and other accommodation for the "Wild West" being ready, and the great amphitheater finished except as regards the roof covering. One very remarkable feature about the exhibition will be the facilities of access it will enjoy, the West Brompton, Earl's Court, and West Kensington stations each being situated close to the different entrance gates.

The plan of the ground occupied is, it will be remembered, very irregular, and cut up by various railways passing through it; but this, under the skillful management with which it is laid out, will add greatly to the charm of the place as a summer resort, while access to every part of the grounds is fully provided for by numerous bridges crossing the lines. The main building is essentially utilitarian, and will be practically devoid of ornament, except for the internal draperies, among which 1,200 American flags and banners will make no mean display. Major Russell, Mr. Landreth, and others of the American executive will shortly arrive in England, and complete the eminently practical and energetic staff already engaged on the enterprise, the work, so far as America is concerned, being complete. The American Exhibition will certainly be a novelty, and we believe one of the greatest attractions London has seen for many years.—*Engineering.*

Wine and Brandy from Raspberries and Strawberries.

Raspberry ferment, *Levure wurtzii* of Le Bel, is not able to convert all the sugar of the raspberry into alcohol. To learn whether this is due to lack of activity in the ferment or to the action of some constituent of the fruit, energetic ellipsoidal wine yeast was mixed with the liquid. Fermentation then quickly ensued, and the sugar of the fruit, as well as two or three times its quantity of added sugar, was converted into alcohol. Raspberry brandy, obtained by distilling the wine, is very aromatic, and has the odor of raspberries, then becomes slightly smoky, but finally acquires a very fine bouquet.

Strawberry ferment is more active, but fermentation is accelerated by the addition of ellipsoidal wine yeast. Wine from French strawberries is less acid than that from raspberries, and keeps well if it contains 16 per cent alcohol. The brandy has a strawberry bouquet, which becomes stronger after some time, but does not alter in character. English strawberry brandy, even if containing a double quantity of added sugar, is still so strong as to be unpleasant, but if diluted with water the bouquet develops in perfection.

Levure wurtzii and others, such as *L. apiculatus*, have no inversive properties, and can therefore act only on invert sugar, and are unable to alter the saccharose, which also exists in the juices of many fruits. A higher yield of alcohol can be readily obtained by adding an inversive ferment like the ellipsoidal yeast of wine.—*A. Rommier, Compt. Rend.; Jour. Chem. Soc.*

Distribution of Power by Rarefied Air.

In the central station of the Rue de Beaubourg, Paris, a 40 horse power plant is now at work actuating vacuum engines in the neighborhood, some of them being situated at a distance of about a third of a mile. Motive power at the central station is provided by a steam engine, which works an air pump producing a partial vacuum in a system of small lead tubes laid underground throughout the district. At the different places where power is required, there are small vacuum engines constructed similar to steam engines, the largest giving out two effective horse power. The plant has worked so well that additional power had to be provided, and two new steam engines, representing 130 horse power, have just been installed at the central station, so that power may now be supplied to an extended circle of customers.

One customer requires at his premises 30 horse power, and for him there are now in construction two 15 horse power vacuum engines. It is also intended to work electric light machinery by means of these engines; but this employment has justly been characterized by M. Hospitalier as a roundabout and uneconomical method of distributing electric light from a central station. Payment for the power supplied is made in the shape of a fixed quarterly rental for the vacuum engine, and an additional charge according to the total number of revolutions made by the engine during the quarter. This method is only a rough approximation, and it is intended to substitute meters which will register the actual energy supplied. At present, the average price of the horse power hour is about 3d. The total loss of the system is estimated at 50 per cent. As the degree of vacuum is approximately in inverse ratio to the distance of the vacuum engine from the central station, it is necessary, before placing an engine, to regulate it according to the position it will occupy, and for this purpose a special apparatus is fitted at the central station, which allows the testing of each motor in the same conditions as it will work under when handed over to the customer.—*Industries.*

APPARATUS FOR ILLUSTRATING THE LAW OF THE REFLECTION OF LIGHT.

T. O'CONOR SLOANE, PH.D.

A simple apparatus for illustrating the equality of the angles of incidence and reflection, and which can be used to demonstrate the law to a number of persons at once, is here illustrated. Besides its simplicity of construction, it possesses the feature that a true reflection of light is used. Sometimes a marble is employed to represent a light ray, and is shot against a flat surface from which it rebounds, and the angles are determined. This gives a representation of the law only, not a demonstration. The methods involving the production and reflection of a parallel beam of light, either from the *porte lumiere* or the calcium light, are very beautiful, but demand a somewhat extensive apparatus, or sunlight. These are not always attainable. In the apparatus shown, a candle is the only source of light needed, and it is sufficient to show the experiment to a roomful of auditors. The room need not be darkened, although a slight degree of obscurity is better. Such as can be produced by ordinary window shades is enough.

A piece of wood is sawed out into a portion of a circle slightly more than a semicircle. At the center of the diameter, which is parallel to the rear line, an inch hole is bored. Into this a circular pin of wood is fitted. The upper portion of the pin is cut away, back to its diameter, so as to leave exactly one-half of the cylinder intact. This portion should be about an inch long.

It is placed in the hole, and is made exactly vertical by wedging if necessary. The plane surface, where the half cylinder is cut away, faces the circular and front portion of the board, and by means of a straight edge is placed as nearly parallel as possible to the line of the back. The pin must be fixed very securely in this position, either by glue or by a screw driven in from the back.

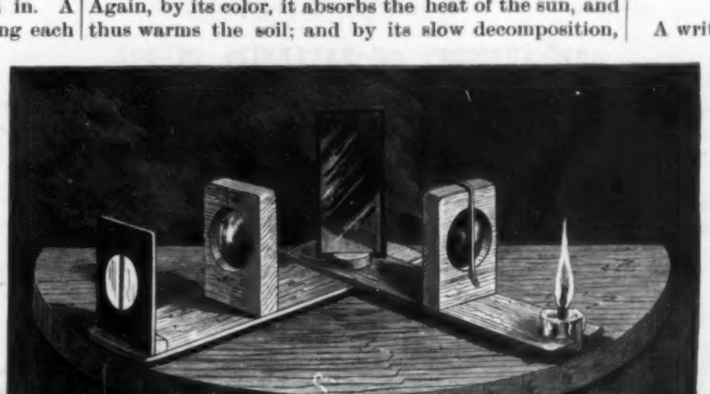
A small piece of looking glass is temporarily attached to the flat surface of the pin. A fine, perfectly straight wire or delicate plumb line is held in front of it near the line of the circle, and is shifted until it covers its reflection in the mirror. The position it occupies is the zero of the divisions, and is so marked on the edge of the circle. From this as a starting point, equal divisions are laid off to the right and left, and numbered in corresponding series. If divisions of equal linear length are used, they will necessarily be equiangular.

Two strips of thin wood are perforated near one end with a hole just fitting the round portion of the pin. Near the front of one strip, a hole is bored of such size as to hold a candle. Near the front of the other, a screen of wood with a half inch hole is secured, over which hole a piece of white paper is pasted. Three or four inches back from the candle on one strip, and from the screen on the other, wooden blocks are secured, which are perforated, and receive convex lenses of correspondingly short focus. Meniscus lenses such as used by spectacle makers answer perfectly. The holes in which they are set should be recessed with a shoulder for the glass to fit against, or rings of pasteboard may be glued on either side to hold them in. A tolerable fastening may be obtained by gluing each lens directly to the face of the wood, the holes being made slightly smaller. It is far preferable to use the other method of setting them in the wood. As one strip rides upon the other, its outer end, by a batten or brass-headed upholsterer's tacks, must be raised to keep it level. The lenses must both be at the same elevation. Hence, for the reason just mentioned, one must set slightly lower in its block. The center of the hole in the screen must correspond with the height of the center of the lenses.

A piece of wire, which should be of spring temper, is bent so as to spring over the lens on the candle bar across the center of the face of the glass, but not touching it. Finally, to secure steadiness, the board should rest upon three feet. Brass-headed tacks such as already mentioned will answer for this purpose. In general terms, the distance from the candle to its lens, and from the other lens to the screen, should be equal to the focal distances of the lenses. The exact relative position is best found by trial, the blocks not being finally fixed until the position has been experimentally verified. The apparatus is used in the manner now to be described, and the relative positions of the lenses is tried in the same way.

The candle is lighted, the mirror is put in place, and the strip is moved until its end comes over any desired number. The other strip with the screen is now moved around until over the corresponding number on the other side of the zero mark. As it reaches this position, the aperture in the screen becomes brightly illuminated, and the shadow of the wire appears crossing the center of the circle. Thus the angles being equal, the light is manifestly reflected at an angle equal to that of its incidence. The lenses must be set so as to bring out the projection of the bar sharply, and to secure good illumination the candle must be placed well below the bottom of the lens. The strips may be moved about from number to number, but the shadow or projection of the wire will only appear crossing the illuminated disk when the numbers correspond.

A piece of looking glass an inch wide and an inch and a half long is large enough, but a larger one is to be recommended. By a rubber band or other fastening it must be secured with its back firmly against the flat surface of the pin. It should correspond in height with the lenses, and the plane of the quicksilver or silvering on its back should correspond with the true diameter of the circle.



APPARATUS FOR ILLUSTRATING THE LAW OF THE REFLECTION OF LIGHT.

Organic Matter in the Soil.

In all well cropped soils, the roots of the crops, together with portions which remain upon the soil, especially when grass is raised, form a gradually increasing amount of organic matter, which becomes incorporated with the soil by plowing and tillage, and adds greatly to the capacity of the soil. The presence of organic matter in the soil increases its fertility by equalizing the amount of water which the soil will retain, so it defends the plants against drouths. It not only absorbs water like a sponge when it rains, but in dry weather it abstracts moisture from the air, which it yields to the plant; besides, it arrests and retains certain kinds of plant food, which might otherwise be washed away or down through the soil by rains. Again, by its color, it absorbs the heat of the sun, and thus warms the soil; and by its slow decomposition, which is going on all through the growing season, it produces carbonic acid gas, which, being dissolved by the water, aids in dissolving and preparing other constituents of the soil to be taken up by the crops. Organic matter is, therefore, to be increased in soils in which it is not naturally too abundant, in every economical way. Hence composts consisting largely of such organic constituents as straw, leaves, swamp hay, sods, weeds, peat, swamp muck, and wood mould, are to be recommended, quickened with stable manure or with wood ashes or lime, in place of concentrated fertilizers, which supply only the constituents supposed to be removed. Those articles, in the form of bone dust, ashes, potash salts, etc., may well be added to any compost, and are thus often most conveniently applied to the soil.—*American Agriculturist.*

STEARNS' NEW BENCH DRILL.

NEW BENCH DRILL.

The new feature of the drill here illustrated consists in the spindle being fed down quickly to the work by simply turning the crank, and by reversing the motion of the crank, the spindle is as quickly drawn from the work. It is 24 inches high, drills $\frac{1}{8}$ to $\frac{1}{2}$ inch hole square with the bed plate. The run of the screw is $3\frac{1}{2}$ inches. The drill stock is $1\frac{3}{8}$ inch in diameter. Each drill is furnished with a chuck, which attaches to the spindle, and will hold a $\frac{3}{8}$ round drill, or the ordinary square tapered shank or brace drill. The balance wheel weighs 6 pounds, which is sufficient to carry an ordinary drill smoothly, and is not heavy enough to break small drills. The bearings are carefully finished with standard size reamers, and all parts are interchangeable. The crank has an extension for large drilling, and all allowances have been made for strength and durability. Excellent material and workmanship are manifested in the construction, making a useful and attractive and highly finished nickel plated machine.

For further particulars address the manufacturers, Messrs. E. C. Stearns & Co., Syracuse, N. Y.

The Pinsk Marshes.

There is in Russia a district as large as Ireland, known by the above title, and wholly impassable from the size and number of its morasses, in addition to which it is covered with an impenetrable forest of undergrowth and tangled jungle, and consequently was utterly useless. To make this vast extent of land available for the purposes of pasturage and agriculture, all that was required, apparently, was a thorough system of draining and clearing, as the land itself, as land, was found good for the proposed purposes. Accordingly, the Russian government has gone to work with a will, and is now, and has been for some time past, energetically engaged in both these useful and important operations, and the work has been crowned with marked success. At present, 4,000,000 of acres have been reclaimed; and during next year, it is proposed that 300,000 more shall be taken in hand by means of 120 miles of canals and dikes. It is further reported that upward of 600,000 acres of once useless bog are now good meadow land, while 2,000,000 acres of impenetrable jungle have been brought into cultivation. In addition to all this, the engineers have built 179 bridges, sunk 577 wells, and surveyed and mapped 20,000 square miles of land. If such a scheme as this can be so successfully carried out by Russia, why should not some such plan be tried in Ireland? A scientific contemporary, referring to this question, says: "The amount of bog in Ireland would, of course, be child's play to the Pinsk marshes, for somehow we are always confronted with bog as the chief source of Irish difficulties. If its annihilation will pay so well in Russia, it ought to do so equally in Ireland; nor should we forget that an undertaking of such magnitude would bring immediate and constant work from the very outset to half the able-bodied population of the country." The suggestion is worth the attention of all interested in the prosperity of Ireland.—*Chambers's Journal.*

A Field for Work under the Sea.

A writer in one of our contemporaries suggests the development of submarine navigation as one of the works of the future. He contrasts the amount of time and thought which has been expended upon the solution of the problem of flight with the little that has been done in the other field. Men have ever shown themselves more anxious to rival the birds than to cope with the element of the fishes. Dædalus' flight from Crete and the fatal melting of the wings of Icarus, his fall and death, are features of one of the most famous legends of antiquity. But we do not read of Dædalus, or of any other inventor of his day, constructing a submarine vessel. Yet under the waters all is peace, where on the surface the floating ship is exposed to the maximum wave action of the unstable element. The character of instability disappears from the ocean at a small depth, and thirty or forty feet down it is the type of constancy of conditions. The prediction is formally made by the writer in question that in the future this mode of journeying will be extensively indulged in. Then Jules Verne's work will read like a prophecy, and twenty thousand leagues, and many times that, will annually be sailed under the sea. Such are substantially the conclusions of our writer. Whether they will be verified or not must be left, we fear, to future generations to see.

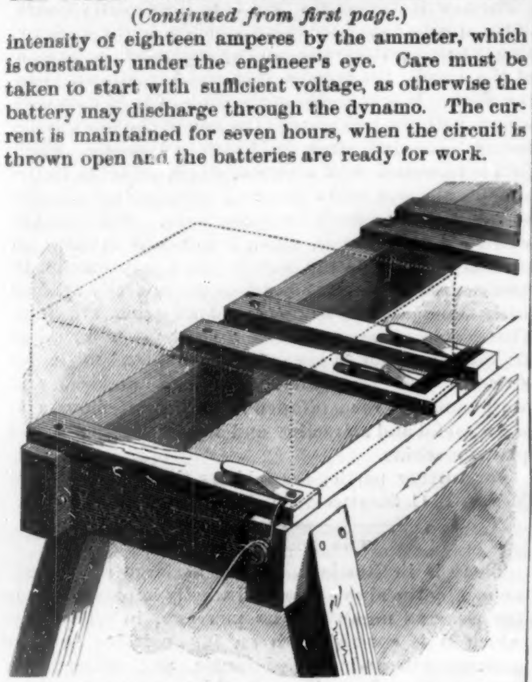
To Restore Gloss to a Silk Hat.

When a silk hat becomes wet, or from other causes has lost its smoothness and gloss, cleanse it carefully from all dust, then with a silk handkerchief apply petrolatum evenly, and smooth down with the same handkerchief until it is dry, smooth, and glossy. This will make a silk hat look as good as new.

THE JULIEN SYSTEM OF LIGHTING RAILROAD CARS.

(Continued from first page.)

intensity of eighteen amperes by the ammeter, which is constantly under the engineer's eye. Care must be taken to start with sufficient voltage, as otherwise the battery may discharge through the dynamo. The current is maintained for seven hours, when the circuit is thrown open and the batteries are ready for work.



SPRING CONNECTIONS ON CHARGING BENCH.

A relay or double set of batteries are provided for the car. When it reaches the depot, a truck is loaded with the five charged cells. It is run alongside of the battery compartment, and the freshly charged boxes are substituted for the exhausted ones. A corresponding arrangement of springs on the floor of the case automatically connects the boxes in series. The spent relay battery is carried on the truck to the charging bench and placed on it ready for the current. All the work is done by the ordinary depot employes, no skill or special knowledge being required. The connections take care of themselves.

Within the car the lamps are arranged in two rows down each side of the car; a total of twenty-four are employed within. Two lamps are also provided for each platform. Upon a partition at the saloon end of the car is the switch box. In it are contained spring switches, by which either the body of the car, or the toilet rooms alone, or the platform lights can be thrown into action, or, if desired, all can be supplied simultaneously.

The general construction of the Julien battery is also shown. The nineteen plates —nine positive and ten negative—are arranged alternately. Each plate is about one-sixth inch thick. The metal of which they are composed is an alloy of lead, antimony, and mercury. They are perforated, so as to represent gratings, and the openings are filled with a mixture of red lead, litharge, and mercury. The use of supporting plates of this composition insures stiffness and prevents buckling, and avoids corrosion in the charging process. The mercury insures a sort of continuity between the supporting plate and the active composition. The internal resistance is about 0·005 ohm.

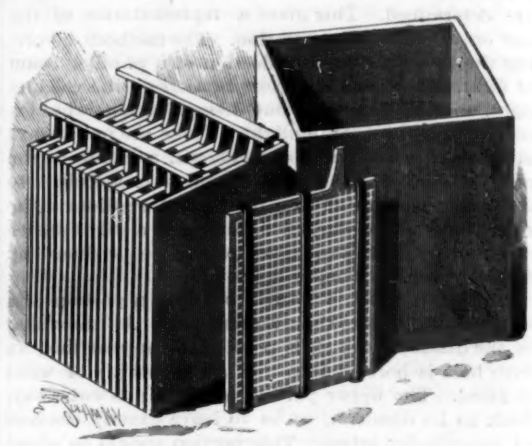
The normal intensity of current is 35 amperes. The lower the rate of discharge is kept, the higher efficiency is attained. On an emergency, it can, without injury, be raised for a short time to 60 amperes. At starting, each cell gives a difference of potential of 2·2 volts, which may fall to 1·7 volts in the discharge. The plates in a single cell weigh 27 pounds. For railroad use they are placed in India rubber cells. Thus established, and filled with acid, the complete cell weighs 34 pounds. The five boxes represent a total of about 1,000 pounds.

To charge these 30 cells, a current of 18 amperes and 75 volts is required, representing about 1½ electrical horse power. Of this current, 82 per cent is claimed to be utilized. In the charging process, it should be noted that the intensity toward the end is dropped to 12 amperes, indicating a lower horse power. Seven hours is required to charge the cells, after which they are run for four and a half hours, at an intensity of about 16 amperes.

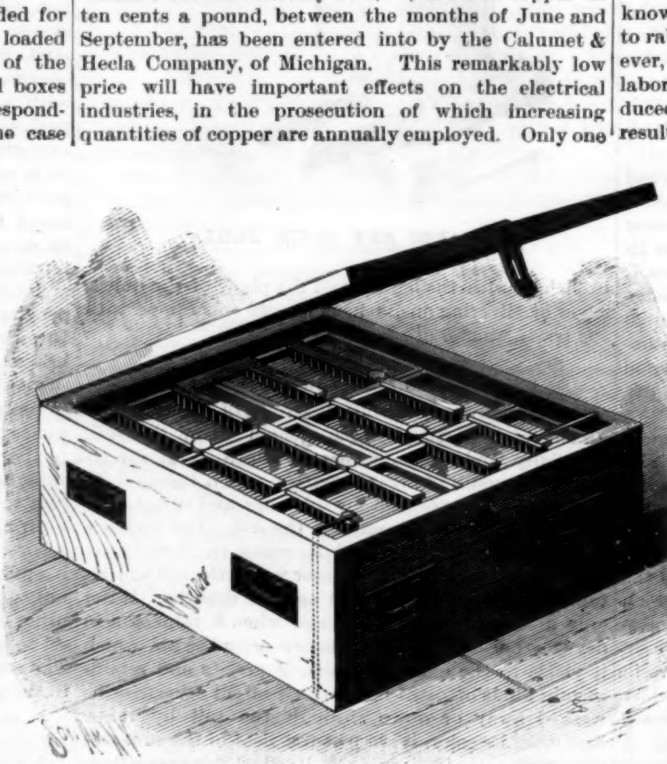
In some cases, the batteries are charged without being removed from the cars. The wires from the dynamo are connected on the switch board to the battery wires, and the operation goes on with all *in situ*. In such installations only one set of cells is required.

The storage battery gives a current free from fluctuations, which is claimed to conduce greatly to the duration of the lamps. In estimates of expense of maintenance, a duration of two months with ten hours' daily use is allowed for the lamps. This is found to be on the safe side. Thus, on the Boston and Albany road, in sixty days' running, out of twenty-four lamps, only three gave out. The other lamps showed no signs of deterioration. The current from a dynamo is subject to many changes, and it seems natural that a lamp should run longer on a storge battery circuit.

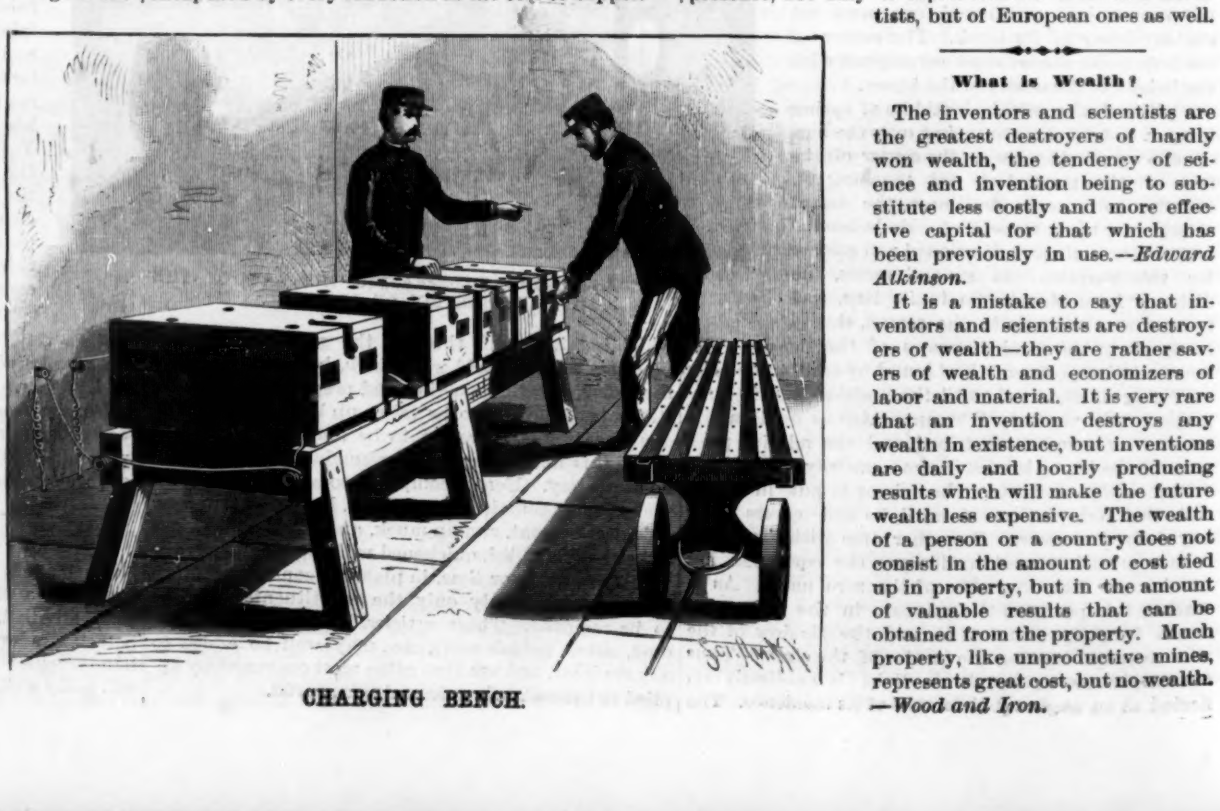
The cost is calculated to amount to about 0·6 cent per lamp per hour. This compares favorably with central station lighting. The effect of the system as established on the cars is very fine. When it is remembered that for a few kerosene lamps situated near the central line of the car roof two lateral rows of twelve 16 C. P. lamps each are substituted, the effect can be realized. The car is literally almost as bright as day. On one train, all the cars are thus lighted, from the baggage to the smoking car. Each one has its own battery and switch board. Great credit is due to the Julien Electric Company for their method of attacking this difficult problem, the safe and economical lighting of moving trains.



THE JULIEN BATTERY.



ARRANGEMENT OF BATTERIES IN BOX.



CHARGING BENCH.

The Price of Copper.

The announcement has recently been made that a contract for the delivery of 8,000,000 lb. of copper at ten cents a pound, between the months of June and September, has been entered into by the Calumet & Hecla Company, of Michigan. This remarkably low price will have important effects on the electrical industries, in the prosecution of which increasing quantities of copper are annually employed. Only one company, the Quincy, it is said, can compete with these prices. The old handicap upon the transmission of power by electricity, due to the price of the conducting wire, is fast disappearing, or at least diminishing, in importance. Dynamo construction, also, will be cheapened by every reduction in the cost of copper.

The Rabbit Pest in Australia.

Mr. H. Taylor, of the rabbit branch of the Mines Department, in his report to the Minister, for December last, said that the total number of men employed in the work of destruction was 2,285, and the rabbits killed 852,739. In the course of the report Mr. Taylor said: "I have, on several occasions, pointed out that the majority of the men engaged as rabbiters were making a very high rate of wages, and it is now reported that a number of skilled tradesmen have been known to abandon their ordinary pursuits, and take to rabbiting as a more lucrative occupation. However, in the thickly infested districts," he adds, "where labor is not scarce, the run owners have recently reduced the rate of bonus;" and he thinks that "this will result in better work being done, as the men will require to work more vigorously to obtain good wages, and, consequently, a greater number of rabbits will be destroyed. Notwithstanding the immense number of rabbits which is at present being killed, it is a matter for great regret that the prospects of eradicating the pest seem as remote as ever—the reports to hand showing that rabbits are slowly, but surely, making their way into the northern portion of the colony; and the run owners in that locality must shortly expect to learn something of the worry and expense attached to the work of rabbit destruction."

The American Association for the Advancement of Science.

The thirty-sixth annual meeting of the American Association is to be held in this city, during the week beginning August 10. The Academy of Sciences has among the local societies taken the lead in the matter of arranging for the reception of the national body, by appointing a committee of conference to secure concerted action among the different institutions of the city. Committees on ways and means, and other permanent organization, it is hoped may be early brought about, as the time is none too long at the best. The meeting last year, at Buffalo, was not a very large one, and offered a contrast to the great Philadelphia meeting of 1885. It is to be hoped that the metropolis will serve as an attraction, and secure the presence, not only of representative American scientists, but of European ones as well.

What is Wealth?

The inventors and scientists are the greatest destroyers of hardly won wealth, the tendency of science and invention being to substitute less costly and more effective capital for that which has been previously in use.—*Edward Atkinson.*

It is a mistake to say that inventors and scientists are destroyers of wealth—they are rather savers of wealth and economizers of labor and material. It is very rare that an invention destroys any wealth in existence, but inventions are daily and hourly producing results which will make the future wealth less expensive. The wealth of a person or a country does not consist in the amount of cost tied up in property, but in the amount of valuable results that can be obtained from the property. Much property, like unproductive mines, represents great cost, but no wealth. —*Wood and Iron.*

MICROSCOPIC NOTES.

BY GEORGE M. HOPKINS.

QUICK METHOD OF MOUNTING DRY OBJECTS.

There is a certain class of microscopic objects that need little or no preparation for mounting, and require no protection beyond a well secured glass cover. Many of these objects are interesting and in some degree valuable; but the microscopist considers them hardly worth

Fig. 1.—QUICK METHOD OF MOUNTING MICROSCOPIC OBJECTS.

the trouble of mounting. For such objects the method shown in the annexed engravings is of great utility, as it permits of inclosing the object quickly, completely, permanently and in presentable form, and while it seems especially adapted to such objects as are common, and

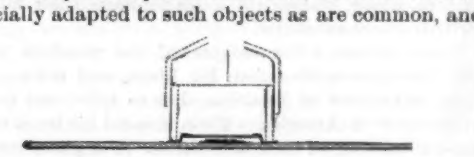


Fig. 2.—SECTIONAL VIEW OF THE SLIDE AND HEATING TOOL.

liable to remain unmounted, it is, of course, applicable to almost any dry object.

To carry out this method, only two articles, in addition to those usually possessed by microscopists, are required; one being the ring, with an internal flange at the top and an external flange at the bottom, the other a heating tool, consisting of a ring of brass attached to a suitable handle.

The rings of which the walls of the cells are formed are spun or stamped from disks of Britannia metal, sheet brass, or other sheet metal, with a narrow internal flange or fillet at the top for receiving the cover glass, and a wider external flange at the bottom, for attachment to the slide. The rings vary in depth according to the depth of cell required. The under surface of each ring is coated with thick shellac varnish and allowed to dry thoroughly. When the varnish is dry and hard a clean cover glass is dropped into each ring, and the ring is placed bottom upward on the warming stand and heated until the shellac melts and thoroughly covers the edge of the cover glass. The ring is now allowed to cool, when the cover will be ready for use. It will, of course, be understood that a quantity of rings and covers are thus prepared and held in reserve. In fact, it is to be hoped that the manufacturers of microscopists' supplies will furnish the rings and covers thus prepared, ready for instant use.

The object to be protected is attached to the slide by means of cement, in the usual way. A ring containing a glass cover is arranged over the object, and the heating tool is warmed and placed upon the outer flange of the ring, as shown in the sectional view, Fig. 2. By this means sufficient heat is imparted to the ring to melt the shellac upon that portion touched by the heating tool, and cause it to attach itself to the glass slide. It is the work of an instant to cover an object in this way, and the slide needs no further finish; but the operator may, if he choose, lacquer the rings to prevent them from tarnishing.

A thin ring provided with the coating of shellac may be applied to an ordinary balsam mount to increase its security.

By applying to the ring a suitable cement, a liquid cell may be made. The object to be mounted in the liquid cell is wet with the liquid and placed on the slide. The ring is then secured in the manner above described, and the liquid is afterward introduced into the cell through an aperture previously made in the side of the ring. This aperture is stopped with cement, applied with a hot wire or needle.

DIMINISHING THE POWER OF AN OBJECTIVE.

It is often desirable to diminish the magnifying power of an objective and at the same time increase its penetration. For example, if one possesses a 1½ inch or 2 inch objective, and desires to examine objects like minerals in the natural state, crystals, seeds, etc., he will find it necessary to focus up and down upon the object to see it in all its parts. A 3 inch or 4 inch objective would furnish the desired power, but it is not at hand.

To increase the focal length, and, at the same time, enlarge the field and deepen the focus, it is only necessary to place a double convex lens of, say, 5 inch focus about half way down the draw tube. The action of such a lens is the reverse of that of an amplifier.

SALICINE WITH HALF OF THE FIELD BACKED WITH MICA.

Fig. 3 of the engravings shows the beautiful circular crystals of salicine in a field partly covered by mica, to exhibit the phenomenon of the reversal of the rotation of the radial color bands by the action of a thin film of mica on the polarized beam. It is difficult to convey the idea fully by means of an illustration in black and white. The crystals are formed on a cover glass and protected by another cover glass, either with or without balsam. A thin film of mica is placed upon the stage of the microscope, so as to occupy one-half of the field. The mount of salicine is then laid on the stage, over the mica, so as to fill the entire field. If the crystals above the mica and those unbacked by mica seem to revolve in opposite directions as the polarizer is turned, no further experiment is necessary, and the salicine, with its mica backing, may be permanently mounted. But if this effect is not secured at first, mica films of different thicknesses should be tried.

Gardening under Difficulties.

The Chinese are a very industrious people, and nothing is allowed to go to waste that can possibly be utilized. As the empire of China is the largest on the globe, and contains nearly half of the entire number of the human race, the necessity of economy is very apparent. They not only cultivate the land, but all of the lakes, ponds, and marshes are gardens in which aquatic plants, suitable for food, are largely raised. Among these the water chestnut is pre-eminent, and is said to be of a very palatable and wholesome nature. In a narrative of Lord McCartney's embassy to China, it is related that his lordship's attendants, in passing through a part of that empire, saw a man cultivating the side of a precipice, and on examination they found he had a rope fastened around his waist, which was secured at the top of the mountain, and by which he let himself down to any part of the precipice where a few yards of available ground gave him encouragement to plant his vegetables and his corn. The whole of the cultivated spots, which were at some distance from each other, appeared to be not more than half an acre, and near the bottom of the precipice, on a hillock, he had a little hut.—*American Agriculturist.*

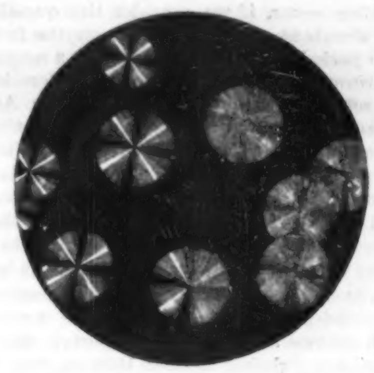


Fig. 3.—CRYSTALS OF SALICINE UNDER POLARIZED LIGHT—HALF OF THE FIELD BACKED BY MICA.

A NOVEL ELECTRICAL EXPERIMENT.

An interesting example of the mutual repulsion of similarly electrified bodies is shown in the annexed engraving.

The divergence of the leaves of the electroscope, the repulsion of electrified pith balls, straws, and silk threads, and the electrification of human hair while being combed, are all familiar examples of the same electric action; but the rubber strips employed in this experiment have the advantage of being readily electrified and of retaining the charge for a long time.

For this beautiful experiment we are indebted to Mr. C. Voorhis, of the National Suspender Company, of the city, who, in handling some of the rubber threads used in the manufacture of suspenders and other elastic webs, noticed that the threads at times repelled each other. The repulsion was naturally attributed to electrification, and the experiment illustrated was at once suggested. The elastic rubber strips used in the experiment (which were seventeen feet long and about one-sixteenth inch square) were suspended from the ceiling in one of the apartments of the SCIENTIFIC AMERICAN office, and were electrified by simply brushing them with a feather duster. The threads became more and more divergent as the electrification proceeded, until it finally became impossible to approach the threads without becoming enveloped in them.

Upon gathering all of the free ends of the threads together, the repulsion of the threads at their mid length caused them to separate widely. When once electrified, in a dry day the threads retain the charge for hours. They can be discharged by connecting them with the ground through the body, by drawing them through the hand.

This curious experiment is one which anybody may easily try at small expense. It illustrates the phenomenon of electrical repulsion in the most striking manner.

REPULSION OF ELECTRIFIED THREADS.

English Views of an American Book.*

Erroneous ideas are entertained by most Englishmen and by many Americans about the relations existing between that portion of the great English-speaking community which remains associated with Great Britain, either at home or in her colonies, and that other portion, now the main body, which prefers to have its own system of government apart from the old country. That the diversity between the two systems of government differentiates these two portions of communities not only English-speaking, but to all intents and purposes British, into different nations, must of course be admitted; but that there ought to be any feeling apart from taste or convenience which should cause any member of either of these communities to attach himself preferably to one rather than to the other seems, if we consider the question as it actually stands at present, absurd on the face of it. During a period extending over about a century and a half, Britons (themselves a race of settlers in Great Britain) settled in various parts of North America, without any feeling that they were deserting their own kindred in thus making homes for themselves elsewhere. Gradually as they grew in numbers, as they gathered together into cities, and as their wealth increased, they appeared of greater importance in the eyes of the home government, as being better worth taxing to supply the sinews of war for contests in Europe. It was not, however, as enemies of Great Britain that they resisted, but in self-defense against the injustice of rulers who regarded nations as a sort of property. They were not Americans fighting against Britons, but Britons in America fighting for independence against the rulers of Great Britain at home. If national rivalry at all were in question, one might say, considering that the King of Great Britain was of almost undiluted German blood, and that besides Britons only Germans fought against the independence of our British race in America, that the contest was between Britons and Germans. This, however, would be to exaggerate the difference between the actual character of the war of independence and what that war is commonly held to be, alike by Britons here and by men of our own British stock in America; and no exaggeration is needed. The mistake actually made is marked enough. It prevents the average Briton from glorying in the noble effort by which our people more than a century ago achieved victory for their just cause; and it prevents the average American from recognizing that it was while Americans were British in name as well as in fact (for this they have always been) that they achieved the independence which is the greatest glory of one of these nations, and should be the greatest glory of both.

America being derived, as we know she was, from an essentially British stock, and being essentially British in blood and character, the Briton who finds it suit his purpose to join the American community has no reason for regarding himself as debarred from so doing by any claims of the home community upon him. There are, in fact, no such claims now any more than there were in the case of those who went out as colonists to America in the seventeenth and eighteenth centuries. Nor should an American who finds it convenient to make the old country or one of its colonies his home, consider that he is deserting his own people any more than a Virginian or a New Englander would so think, who found it convenient to return to England in the old days, before the war of independence had definitely separated the British race into communities having different governments. The only kind of patriotism which can be regarded by reasoning men as a virtue is loyalty to the people; loyalty to a form of government and loyalty to a tract of land are qualities appropriate only to semi-savage races.

If all Britons believed in monarchy, not only as a system which it would be inconvenient to change, but on principle, and if all Americans were equally earnest in the belief that a man is necessarily degraded who remains within a community ruled (even nominally) by a sovereign, the case would doubtless be very different. It would then be a point of patriotism for a Briton to remain British and for an American to remain American. Or if war were likely, one might almost say if war were possible, then—as war, essentially degrading, necessarily brings with it many unpleasant conditions—it might be a sort of duty for Americans and Britons alike to remain severally under their own respective flags. But Britons are not monarchist nor Americans republican in that foolish sense. The Briton knows that he has taken nearly all effective evil out of monarchy—for all at least who respect the dignity of their manhood. (As for the rest, those who being free prefer to ape slavery, and having the right to stand erect fall to boot licking—with an appetite—it matters little what form of government they have.) The American, in like manner, knows that if he and his fellows willed they could substitute a king for a president, yet give up no atom of their freedom or their self-respect.

* "Triumphant Democracy; or, Fifty Years' March of the Republic." By Andrew Carnegie. London: Sampson Low, Marston, Searle & Rivington.

The Briton, even if he call himself (not being concerned about trifles) a subject, is as free from all real subjection as the American citizen. If he speaks with esteem or respect of any king or queen who chances, as has happened, to be virtuous and intelligent—or even both—it is as men or women he regards them, and his respect implies no admission that the original atrocities were just by which the English monarchy was founded and the people temporarily brought into real subjection. Still less does such reasonable esteem for a king or queen chancing to be worthy of esteem imply approval of the wars, the iniquities, or the immoralities by which nearly all the rulers of this country afflicted and offended the people in past times. The American in like manner knows that neither his own people nor the kindred people here would suffer such iniquities or anything approaching to them to be perpetuated, even though America should choose to give to its government the title of monarchy, or though Great Britain still allows the name to remain after the evil of it is dead.

As for war, if war is possible between two such communities as Great Britain and America, then the shame of that is such as to overshadow any such shame as might belong to being on one side or the other side in a contest which would be unutterably degrading to both.

These remarks have been suggested by the reading of Mr. Andrew Carnegie's interesting work, "Triumphant Democracy." It brings before the reader more thoroughly than any book we have yet seen the importance of the ethnic question in considering the fortunes of a nation, and the comparative insignificance of the particular form of government which the nation may find convenient. Mr. Carnegie calls his book "Triumphant Democracy," but, so far as we can see, he in no sense shows that democracy, as such, has had much to do with the progress of America. Democracy regarded in its negative aspect has been, doubtless, all-important in determining the fortunes of the States. But this implies only the converse proposition that a nation which begins its career in a state of actual subjection to more or less rapacious rulers, and their plunder-loving followers, cannot possibly make rapid progress until it has shaken itself free and replaced a state of real subjection by one of practical citizenhood. If the progress of America during the last century has been almost incomparably more rapid than that of the old country, it has not been because of any inherent virtue in democracy, but because the progress of America as a nation has not been hampered by oppressive misgovernment. There is curious evidence of this in the degeneracy of the present race of politicians in America. England would be ruined in a couple of generations if her politicians were as worthless as those who have attained power in America (we make no comparison in regard to English statesmen, for there are no statesmen in America).

But what good fortune it is to a nation to be let alone, to have a fair start in national life, instead of having to struggle out from under a dead weight of oppression, this book shows well. We commend it to the careful study of those who imagine that they have settled the whole question by pointing to municipal bribery at New York, corrupt State legislation at Albany, and iniquitous political life at Washington. Compare the nation fairly and truly pictured in this book, a nation about as much to be judged by its politicians as England by lords-in-waiting and other flunkeys at court, with the America of a hundred years ago—extending the comparison so that while the former is compared with the England of to-day, the latter is compared with the England of a hundred years ago—and it will be felt, we think, that America must have had some immense advantage in the race. What that advantage has been cannot well be doubted. Democratic government has done little for America, and of late the little that her politicians have done has been harmful; but the power and the right which Americans possess to go their own way, and their manful determination to hold that right, let governments, their own included, do what they will, have been all in all to the great nation of our kinsmen across the Atlantic. Even the possession of the suffrage by persons utterly unfit to vote on any higher question than the paving of a back alley has not been able to do one-thousandth part of the harm one might have expected.

An illustrative map taken from an old edition of the "Encyclopædia Britannica," is as strongly suggestive of what America was when that map was thought sufficient as is the letterpress of that work so far as it relates to the United States. Not one page in all is devoted to the description of the infant nation which had just begun to run alone. Except for a line or two about Virginia, one might suppose the States were still British colonies, though the edition bears date 1783. Not a single line implies that there had been any contest worth mentioning, on the other side of the Atlantic. The map was manifestly drawn to correspond with this feeling of contemptuous indifference for the young nation.

America was, indeed, but a small nation then, though it deserved the respect and sympathy of Great Britain, since, while as yet it was not America, but a community of British colonists, it had maintained its just claims to independence against the full strength of the mother country. But consider what it is now! The three millions of 1770 had grown to thirteen millions in 1830, and now to nearly sixty millions—"more English-speaking people than exist in all the world besides," more than the whole population of the United Kingdom, *plus* twice the population of the British colonies. In 1850 the total wealth of the United States was 1,686,000,000*l.*, that of Great Britain being 4,500,000,000*l.*; now the wealth of Great Britain is about 9,000,000,000*l.*, or almost exactly double what it was in 1850; but the wealth of the United States had risen in 1880 to 9,790,000,000*l.*, and is now nearly 11,000,000,000*l.* In 1850 it was hardly worth while to mention America's manufactures in the same breath with those of Great Britain; in 1880 British manufactures amounted to 818,000,000*l.*, those of the States to 1,112,000,000*l.*—nearly half as much as the manufacturing wealth of the whole of Europe. As our author well puts it, though Great Britain manufactures for the whole world, while America is gaining only the control of her own markets, British manufactures in 1880 had not two-thirds the value of those of the century-old republic. The annual savings of America are 210,000,000*l.*, exceeding those of the United Kingdom by 50,000,000*l.*, and those of France by 70,000,000*l.* In comparing the American carrying business with that of Great Britain, we seem to find the younger country behind, since the American shipping amounts to but nine millions of tons, that of Great Britain to eighteen millions. But when we consider the internal commerce between the States, we recognize a difference the other way. This internal commerce exceeds the entire foreign commerce of Great Britain and Ireland, France, Germany, Russia, Holland, Austro-Hungary, and Belgium combined. The Pennsylvania Railroad system, alone, transports more tonnage than all our British merchant ships!

These are but a few samples of the wonders which Mr. Carnegie—a Scotsman by birth, and not a politician, but a man of business—has to tell about the development of America. We commend his book to the careful reading of men who think. For party men, or men otherwise liable to be swayed by mere prejudice, the work will be pleasing or irritating, according to the direction in which their proclivities tend. But for those who look hopefully, or at least longingly, to the future of the human race, it is a work whose every page will be full of meaning.—*Knowledge.*

Melting Points of Metals.

Metals.		Centigrade.		Fahrenheit.
Aluminum	degrees	700	degrees	1,292
Antimony	"	425	"	797
Arsenic	"	185	"	365
Bismuth	"	264	"	507·2
Cadmium	"	320	"	608
Cobalt	"	1,200	"	2,192
Copper	"	1,091	"	1,995·8
Gold	"	1,381	"	2,485·8
Indium	"	176	"	348·8
Iron, wrought	"	1,530	"	2,786
Iron, cast	"	1,200	"	2,192
Iron, steel	"	1,400	"	2,552
Lead	"	334	"	617
Magnesium	"	235	"	455
Mercury	"	—40	"	—40
Nickel	"	1,600	"	2,912
Potassium	"	62	"	143·6
Platinum	"	2,600	"	4,712
Silver	"	1,040	"	1,904
Sodium	"	96	"	172·8
Tin	"	235	"	455
Zinc	"	412	"	773·6

Simple Test for Wall Paper.

A simple and easily applied test for wall papers has been devised by Mr. F. F. Grenstted. No apparatus is needed beyond an ordinary gas jet, which is turned down to quite a pin point, until the flame is wholly blue. When this has been done, a strip of the paper suspected to contain arsenic is cut one-sixteenth of an inch wide and an inch or two long. Directly the edge of this paper is brought into contact with the outer edge of the gas flame a gray coloration, due to arsenic, will be seen in the flame (test No. 1). The paper is burned a little, and the fumes that are given off will be found to have a strong garlic-like odor, due to the vapor of arsenic acid (test No. 2).

Take the paper away from the flames and look at the charred end—the carbon will be colored a bronze red; this is a copper reduced by the carbon (test No. 3). Being now away from the flame in a fine state of division, the copper is slightly oxidized by the air, and on placing the charred end, a second time, not too far into the flame, the flame will now be colored green by copper (test No. 4). By this simple means it is possible to form an opinion, without apparatus and without leaving the room, as to whether any wall paper contains arsenic, for copper arseniate is commonly used in preparing wall papers. Tests one and two would be yielded by any paper containing arsenic in considerable quantities.—*British Medical Journal.*

HOW TO MAKE STATUARY IN PAPER.

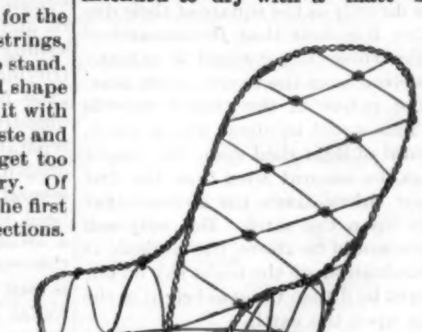
A new branch in the art of home adornment, which is well worthy of attention, has been wrought by Mrs. Cordelia Shont, of Pittsburg, Crawford Co., Kansas. Our notice was first called to the work of this artist by Mrs. A. N. Leigh, of the same place, who sent us a photograph of the originals from which our engraving has been produced. The principal example is a graceful statue of a female figure, made of paper, and there are also vases and chairs. Our engraving hardly does justice to the statue, which is quite an artistic production. As all these specimens are of home manufacture, we have thought it would be interesting to our readers to learn from the author herself how they were made, and we accordingly give the following account, which Mrs. Shont has kindly furnished to us:

"You will see by the photograph that the principal piece of work is a statue, the title of which is "Surprised at the Bath." The expression is intended to be one of displeasure. It is five feet high, weighs ninety pounds, is made of waste wrapping paper and flour paste, and finished with several coats of white lead.

"There are three vases and two chairs made of paper, which have been in use for nearly a year, and have not suffered from use.

"The statue is solid. There is a wire frame for the limbs and head. I wound it with stout cloth strings, wet in flour paste, let it dry until firm enough to stand. Then I put on the paper until it was the desired shape and size, always letting it dry after going over it with two or three thicknesses of paper wet with paste and well pressed down with my hands. When I get too much on in one place, I whittle it off when dry. Of course, the more nearly correct it is made in the first place, the less work there will be to make corrections.

"Taking everything in consideration, I think paper is the best material for working out one's ideas in art or ornament that has ever come in use, because every one can get the material, and if we fail or make a mistake, or wish to change, we can do so without losing all of the work. After I had the statue nearly done, I changed it by sawing the neck and waist in to the wire, then turned and bent in the shape desired, cut out some wedge-shaped pieces of paper, and pasted them in the cavity until it was all solid and firm as ever.



"The chairs have wire frames tied where the wires cross, with strings wet with paste, then filled and pressed in between with paper till even with the wire, and as much more as desired. Pieces of stout cloth are good where increased strength is required, always finishing with paper. The paper can be rasped to make it straight. Sandpaper and oil paint make a good finish.

"The vases are made by cutting paper and sawing or pasting it in shape. It is best not to put too much paper on at once, but dry often.

"I commenced the statue last June, and had it ready for the fair in October. It might take longer to make one in marble. In paper we can try as often as we please to improve the expression. Marble may always be considered the best in art, but paper has a great many advantages. It can be knocked about with little care, and if broken can be repaired. I executed this work and hardly missed the room it took in the house. It is light and easily carried and stowed away anywhere, when I had other work to do. I never would have had a chance to do in marble what I have and can do with paper, and that may be the case with many others.

"I send three sketches; the heavy lines, five in number, in the statue represent the length of the wires. They can be bent any shape to suit. It is easier to make the hands and ears separate, then fasten in and finish afterward. The feet must be made solid at first, or they will not bear the weight if moved while damp with new paste.

"The crosses in the chair show where the wires are tied with pasted strings. Then paste on and fit in as stated before.

"A cone-shaped paper is all that is necessary for a straight vase; for a very slim stem, a wire frame will make it so stout there will be no danger of breaking."

HOW TO MAKE PAPER STATUARY.

Varnishing Glass.

BY NELSON K. CHERRILL.

In a recent number of the *Electrician* it is mentioned that Messrs. Siemens and Halske have recently adopted the system of dipping lamps in a thin semi-transparent varnish to obtain the effect of ground glass. As the writer has had much experience in this class of work, a few notes of the best mode of procedure may be of interest. The application of various modifications to the normal appearance of a lamp by means of varnish, either colored or plain, is by no means a novel expedient, and a similar plan has, I believe, been commonly employed in many places for decorative work.

The most important point in the application of varnish to a lamp is to get it to dry just in the right condition. Most kinds of varnish that will dry "bright" under ordinary circumstances will become "matt" if subjected to a chill, or to the action of damp during the drying, and at the same time many varnishes intended to dry with a "matt" surface, that would represent ground glass, dry "bright," if the conditions of drying are not quite suitable.

The class of varnish best adapted to this kind of work is what is known as photographer's negative varnish. This class of varnish dries almost as hard as the glass itself, and when well applied is very durable. When colored lamps are needed, the varnish should be of a quality to dry "bright," but when the effect of ground glass only is required, the simplest way is to use what is known as "retouching" varnish, which gives a "matt" surface at once. In default of this, the ordinary negative varnish can be easily modified to give the desired surface by the addition of a little weaker alcohol, which almost always has the desired effect; but if there is any difficulty, a little common resin, which chills very easily in drying, may be added to the varnish.

As to the mode of applying the varnish to the lamps, the best plan is to hang them on a frame by their contacts, so that a current can be passed through them during the operation. The lamps should be well washed in warm water, in which there has been dissolved a liberal dose of soda. A thorough rinse with fresh cold water should be given, and the bulbs should then be carefully wiped quite dry with clean linen rags. If the work is to be very nicely done, the operator who hangs up the lamps on the screen should have on linen gloves, as finger marks on the glass are apt to show when the whole process is finished. The varnish is poured into an upright glass vessel large enough to contain the lamp. A common drinking glass is as good as anything, if large enough to admit the lamp. In pouring out the varnish, care should be taken not to disturb any sediment which may be at the bottom, and if not quite clear it should be filtered, as it is of the greatest importance to avoid any small floating particles, which would cause spots or streaks on the finished surface.

All being ready, if the varnish is to dry bright, *i. e.*, for colored lamps, etc., switch on the current to the lamp for a few moments, so as to render it slightly warm. Then turn it off, and taking the glass of varnish in the left hand, raise it under the lamp until the whole globe is immersed. If the lamp is in any kind of rigid fitting it will be very easy to immerse it, but if it is merely hung on a couple of wires, it will require the aid of a little instrument, consisting of a forked piece of wood, to push the globe down into the varnish. As soon as the varnish entirely covers the globe, lower the glass with one steady movement, so that the draining off the superfluous varnish shall be commenced in one even wave all over the globe. Any hesitation or pausing in the motion of the glass will be almost sure to cause a line on the finished lamp.

As soon as the tumbler of varnish is quite clear from the lamp, turn on the current again, and leave it running, while several more lamps are being done. When about twelve lamps have been varnished, the first will be ready to come off. But a little care must be taken till the lamp is quite cold, as some varnishes will finger mark readily at this stage. If the varnish is to dry "matt," the lamp should be plunged quite cold, and no current should be put into the lamp till the varnish has chilled all over, then a little warmth will aid the drying, and will also harden the varnish. Almost any color can be given to the varnish by the simple use of Judson's dyes, which will readily mix with the varnish and impart their characteristic tints.

Blue is the most difficult color to arrive at satisfactorily, as the dye does not seem to blend so well with the varnish as the other colors, and, besides, the color is spoilt by the yellow tone of the light. To avoid this part of the difficulty, the lamps which are to be used blue should be run as *hot* as possible, while those for red or yellow colors may be comparatively cool, the yellow especially so.

It goes without saying that all the testing of the lamps must be finished before the varnishing is commenced.

A pleasing effect is sometimes produced for purely decorative work by using a little dye with the "matt" varnish.

THE lightest production of quicksilver in the United States for the last ten years was last year's, being only 27,756 flasks. The increased imports of nearly 8,000 flasks from England to the United States include the large transit trade of that article to the Mexican mines.

Life in a Sun Cluster.

In the constellation Hercules there is a compact star cluster well known to owners of powerful telescopes as one of the most interesting and wonderful phenomena to be found in the heavens. To the naked eye it looks like a faint star. In the telescope it appears as a spherical mass of stars, with short, straggling streams, also composed of stars, radiating from it. William Herschel computed the number of stars in this cluster at not less than 14,000. In the center they appear so compressed that it is impossible to count them.

Of course, every one of the members of this starry swarm is a sun, and astronomers have sometimes piqued their imagination by wondering what must be the condition of things prevailing in such a system of suns, and what results flow from the inevitable laws of gravitation there. Could inhabited worlds exist in a sun cluster?

A calculation of the probable size of the stars in the cluster in Hercules, and of the average distance which separates one from another, has just been made in England by Mr. J. E. Gore. He concludes that they have an average diameter of 45,000 miles, and that the distance from any star in the cluster to the next star is 9,000,000,000 miles.

Taking Mr. Gore's figures as being probably as near the truth as we can get, a little consideration will give us some very interesting results. If the stars in question are only 45,000 miles in diameter, the surface of each possesses an area about one-quarter as great as that of the planet Jupiter. Their distance apart, as calculated by Mr. Gore, is more than twenty times the present distance of Jupiter from the earth. Just now Jupiter shines brighter than any star in our sky, with the exception of Venus. If its disk were reduced to one-quarter of its actual size, and it was removed twenty times as far away as it is, it would become invisible to the naked eye.

But Jupiter shines only by reflected light, while the stars, being suns, shine with their own light, which is enormously more brilliant than that of a planet. So if we wish to get an idea of the amount of light shed by one of these clustered suns in Hercules, we must put a body that shines after the manner of the sun in the place of Jupiter. Now, if we should remove the sun to a distance of 9,000,000,000 miles, or, roughly, a hundred times as far away as it actually is, it would send us only one ten-thousandth part of the light that we now receive from it. Then, if we should reduce it to a diameter of 45,000 miles, equal to that of the stars in the Hercules cluster, its light would be reduced about 360 times more, so that it would then shine to us with only one three-million-six-hundred-thousandth part of the light that it now sheds upon the earth. This, then, supposing that the intrinsic brilliancy of the stars is the same as that of the sun, would represent the amount of light that one of the stars in the cluster sends to its next neighbor.

But in order to get a conception of the appearance that such a star would present, we must compare its light with that of the stars in our sky. This comparison involves a good deal of uncertainty, owing to the great differences in the various estimates that have been made of the brightness of the stars as compared with the sun or moon. Still, we can probably get near enough to the truth for our purpose. Take the bright star Sirius, the most brilliant fixed star in the heavens. Any one who wishes can see it in the southern heavens early in the evening at this season. Various estimates of the light of Sirius have made it from one twenty-thousand-millionth up to about one five-thousand-millionth of the sun's light. Suppose we adopt the latter figure as being the most favorable to Sirius. Then, comparing this with the fraction representing the light of a star in Hercules as seen from its nearest neighbors in comparison with that of the sun, namely, one three-million-six-hundred-thousandth, we find that the light of the star is nearly 1,400 times as great as the light that Sirius sends to us. In other words, if we could visit the cluster in Hercules, we should find that its stars, as seen from a distance of 9,000,000,000 miles, their average distance apart, would shine 1,400 times as bright as Sirius shines in our sky.

Sirius is probably 500 times as bright as the faintest star that the naked eye perceives on a clear night. Then imagine a star three times as much brighter than Sirius as Sirius is brighter than the smallest star you can see, and you will have some notion of the brilliancy of the stars in question as seen from one another.

Now let us suppose a world revolving around a star situated at the center of the cluster. Assuming that the surrounding stars are arranged in a pretty symmetrical way, there would be a dozen of them within a distance of 9,000,000,000 miles, and each of these would, as seen from the world at the center, appear 1,400 times brighter than Sirius appears to us. There would be upward of fifty stars twice as far away, each of which would be 350 times as bright as Sirius. Thus the stars of the cluster, as seen from the center, would go on increasing in number and diminishing in brightness; but as the total number is limited to 14,000 or 15,000, the outermost stars would be approximately 135,000,000,000 miles away, and each would shine six times as bright as Sirius.

It is apparent that there would be a sort of perpetual daylight at the center of such a congregation of suns. Let us see about how bright this light would be. Of course our supposititious planet might receive from the sun to which it belonged as brilliant a daylight as our sun gives to us, but what would be the illumination of its nights; or, in other words, of that side of it which was turned away from its sun? Zollner has estimated the light of the sun to be 618,000 times as great as that of the full moon. This, upon the estimate of the amount of Sirius' light as compared with the sun's that we have adopted, would give the moon about 8,000 times as much light as Sirius.

Since each of the stars in the cluster has 1,400 times the light of Sirius, at 9,000,000,000 miles distance, and there are a dozen of them within that distance of the center, it follows that these dozen stars will shed above twice as much light upon a world in the center of the cluster as the full moon sends to us. And since the light received from a body varies inversely as the square of its distance, while the number of such bodies arranged in the roughly spherical way we have supposed would increase directly as the square of their distance from the center, it is clear that the amount of light received from the whole cluster would be as many times the amount received from the twelve stars nearest the center as the radius of the cluster exceeds 9,000,000,000 miles. This would be about fifteen times, and so the total amount of light shed upon the center would be fifteen times the amount shed from the first twelve stars, or about thirty times the amount that the full moon pours upon the earth. But only half the stars of the cluster would be above the horizon at once, and so the illumination of the night sky on our imaginary world would be fifteen times as bright as the light of the full moon upon the earth.

The number of stars visible to us with the unaided eye on a clear night is not over 3,000, and the great majority of these are so faint that they require some attention to be seen at all. How contemptible, then, is the starry firmament presented to us in comparison with the glorious heavens in this sun cluster of Hercules, where more than twice as many stars as we can see blaze nightly with a radiance so brilliant that the faintest of them are six times as bright as the greatest star in our sky!

Indeed, the light of all these astonishingly bright stars diffused in the atmosphere of our imaginary planet would be so great as largely to rob the individual stars of their brilliance, just as the light of the moon or the blaze of the electric lights upon the Brooklyn bridge serves to partially efface the stars in our sky.

Another effect of this splendid display of stars would be to shut out from the view of the inhabitants of the center of the cluster all the outside universe. In the flood of light poured from the members of the cluster the other stars beyond them would be invisible, and the dwellers within the system would be, so to speak, shut up in a little universe of their own, knowing nothing of the greater universe beyond, in which we see their cluster floating like a mote in the sunbeams.

It remains to consider briefly what would be the condition of things upon a world circling around one of the stars at the outer edge of the cluster. Here, as a moment's thought shows, the appearances presented would be very different from those at the center of the cluster. Less than half of the sky visible from such a planet would be occupied by the brilliant stars of the cluster, while the other half would be, so to speak, open to the universe outside. The appearance of its night sky would depend upon the position of the planet in its orbit, and also upon the situation and inclination of that orbit with reference to the cluster. At certain seasons, the inhabitants of such a world might have a blazing nocturnal spectacle like that enjoyed by a world at the center of the cluster, or might see half of their visible firmament occupied by those splendid stars, while the other half was almost a blank by contrast; and at other seasons the stars of the cluster might be entirely concealed, and they would look off into the same starry universe that we behold. Or the orbit of the planet might be so situated that the clustered splendors we have described would be visible from only one of its hemispheres, so that the inhabitants of the other hemisphere, hearing the fame of this great celestial display, and desiring to behold it, would have to journey half around their globe to gratify their curiosity, as we have to go into the southern hemisphere to see the Southern Cross, the Magellanic clouds, and other celebrated sights of the austral sky.

But, somebody may ask, can inhabited worlds exist in such a system as that described? We certainly have no reason to think it impossible that they should. It is difficult, however, to understand just how the cluster itself exists. The complicated attractions prevailing among its members put it beyond the power of mathematical analysis to unravel their orbital motions. But facts are stronger than theories, and our eyes assure us that the cluster is there. Moreover, it is by no means the only phenomenon of the kind in the heavens. There are many star clusters, some as compact as this one in Hercules. As to the question of life in them, it can, perhaps, neither be proved nor disproved. But it is more agreeable to the mind, and more in accordance with the progress of science, which tends continually to establish the unity of the physical universe, to believe that intelligent beings enjoy the splendors of these distant capitals of space, than to think of them as barren and tenantless—mere spectral lights amid the "Saharas of creation."—*N. Y. Sun.*

The Finest Fibers.

At a recent meeting of the Physical Society, a paper was read "On the Production, Preparation, and Properties of the Finest Fibers," by Mr. C. V. Boys, M.A. The inquiry into the production and properties of fibers was suggested by the experiments of Messrs. Gibson and Gregory "On the Tenacity of Spun Glass," described before the society on February 12, and the necessity of using such fibers in experiments on which Professor Rucker and the author are engaged.

The various methods of producing organic fibers, such as silk, cobweb, etc., and the mineral fibers—volcanic glass, slag wool, and spun glass—were referred to, and experiments shown in which masses of fibers of sealing wax or Canada balsam were produced by electrifying the melted substance. In producing very fine glass fibers, the author finds it best to use very small quantities at high temperatures, and the velocity of separation should be as great as possible. The oxyhydrogen jet is used to attain the high temperature, and several methods of obtaining a great velocity have been devised. The best results obtained are given by a cross bow and straw arrow, to the tail of which a thin rod of the substance to be drawn is cemented. Pine is used for the bow, because the ratio of its elasticity to its density—on which the velocity attainable depends—is great. The free end of the rod is held between the fingers, and when the middle part has been heated to the required temperature, the string of the cross bow is suddenly released, thus projecting the arrow with great velocity, and drawing out a long, fine fiber. By this means fibers of glass less than one ten-thousandth inch in diameter can be made.

The author has also experimented on many minerals, such as quartz, sapphire, ruby, garnet, feldspar, fluorspar, augite, emerald, etc., with more or less success. Ruby, sapphire, and fluorspar cannot well be drawn into fibers by this process, but quartz, augite, and feldspar give very satisfactory results. Garnet, when treated at low temperatures, yields fibers exhibiting the most beautiful colors. Some very interesting results have been obtained with quartz, from which fibers less than one one-hundred-thousandth inch in diameter have been obtained. It cannot be drawn directly from the crystal, but has to be slowly heated, fused, and cast into a thin rod, which rod is attached to the arrow, as previously described. Quartz fiber exhibits remarkable properties, as it seems to be free from torsional fatigue, so evident in glass and metallic fibers, and on this account is most valuable for instruments requiring torsional control. The tenacity of such fibers is about fifty tons on the square inch. In the experiments on the fatigue of fibers, great difficulty was experienced in obtaining a cement magnetically neutral, and sealing wax was found the most suitable.

An experiment was performed illustrating the fatigue of glass fibers under torsion, and diagrams exhibited showing that the effect of annealing them is to reduce the sub-permanent deformation to about one tenth its original amount under similar conditions. Annealing quartz fibers does not improve their torsional properties, and renders them rotten. Besides the use of quartz for torsional measurements, the author believes that quartz thermometers would be free from the change of zero so annoying in glass ones. He exhibited an annealed glass spiral, capable of weighing a millionth of a grain fairly accurately, and also a diffraction grating, made by placing the fine fibers side by side in the threads of fine screws. Gratings so made give banded spectra of white light.

Apes as Workers.

The ideas of M. Victor Meunier with regard to the domestication of apes are discussed in the new number of the *Revue d'Anthropologie*, by Madame Clemence Royer, the French translator of Darwin. Madame Royer does not doubt that, under a proper system of training, apes might be made good workers. They lack perseverance, indeed, but in general intelligence they are, she thinks, superior to the dog, the horse, or even the elephant. She points out, however, that it would be necessary to feed domesticated apes with great quantities of fruit, bread, and eggs, that the process of educating them would be costly, and that for many generations they would probably be injuriously affected by the climate of Europe. Her opinion is that, if the experiment is to be made, it should be made first of all in tropical countries, where apes might be taught to labor in connection with the cultivation of coffee, cocoa, and cotton.

ENGINEERING INVENTIONS.

A railway signal has been patented by Mr. David Tapley, of Woodstock, New Brunswick, Canada. It is a semaphore so constructed that the signal may be set at any distance from the station, and operated by a boy over two thousand feet of wire passing around curves, the invention covering various new and useful improvements.

A steam engine has been patented by Mr. Adam Rosenkranz, of Allegheny, Pa. The engine case is formed with four cylinders, set opposite each other in pairs in the form of a cross, and all opening into a common central chamber in which rotates the crank of the engine shaft, being intended to rotate the driving shaft in either direction, operating under control of a single rotatory valve, and fitted with ports and a slide valve to allow instant reversal.

MECHANICAL INVENTION.

An auger bit has been patented by Mr. Charles H. Irwin, of Martinsville, Ohio. It has a solid center stem formed with a single convoluted blade, terminating at its lower end in a single chisel on one side of the stem, with a short additional convoluted blade at the same end of the stem, terminating at its outer end in an additional chisel on the opposite side of the stem, making a partially double and a single twist central stem auger bit applicable for hand and machine work.

AGRICULTURAL INVENTIONS.

A check row planter has been patented by Messrs. August F. Tiede and Jairus Wilcox, of Preston, Iowa. The invention covers a novel construction and combination of parts, the machine being intended to space off the dropping of the seed to secure accurate check row planting over uneven ground, and to distinctly mark the earth so that the regularity of the planting may be tested as the work progresses.

A farm gate has been patented by Mr. Philip Ramminger, of Greenwood, Wis. It is so constructed that when the gate swings either way, a toothed plate on the base of the posts intermeshing with a toothed segment on the gate causes the outer end of the gate to rise gradually, in such a way that it will close automatically by the effect of gravity, the construction being simple and the gate swinging very easily.

A combined cotton seed planter and fertilizer distributer has been patented by Mr. John I. Boswell, of near Chase City, Va. The machine has an opening plow, and is so constructed that the seed and the fertilizer will be guided into the bottom of the furrow opened by the plow, the amount of fertilizer discharged being easily regulated, with other novel features, the invention being an improvement on a former patented invention of the same inventor.

MISCELLANEOUS INVENTIONS.

A pocket protector has been patented by Mr. David J. Scott, of Ridgeway, N. C. It is a novel form of cheap and simple device, to attach to a garment without disfiguring it, for retaining the mouth of a pocket in a closed position, preventing the falling out of pencils, cigars, pocket books, etc.

A shirt has been patented by Mr. William B. Brokaw, of Newburg, N. Y. This invention provides an improved mode of uniting the bosom portions over the breast of the wearer, whereby the fastenings may be readily and quickly detached, thereby permitting the shirt to be conveniently washed, free of any obstructions.

A vehicle for delivering coal oil, etc., has been patented by Mr. Charles H. Weygant, of Newburg, N. Y. In connection with a vehicle adapted to carry a tank or barrels is a pump, measuring tank, and hose and reel, by which the liquid may be measured and conveniently transferred to some distance, and delivered above or below the vehicle.

A bookbinder's gold cleaning and saving machine has been patented by Mr. John N. Ives, of Brooklyn, N. Y. Wipers of soft rubber or other suitable material are employed, carried by a rotating frame inclosed in a box or suitable casing to retain the particles of gold removed by the wipers, the invention covering a novel construction, arrangement, and combination of parts.

A chute for cleaning coal has been patented by Mr. Peter F. Henigan, of Pittston, Pa. This invention covers a novel construction and arrangement of the longitudinal bars in a screening chute, providing for the automatic clearance of the slate as well as the culm, making the device a slate picker as well as cleaning chute.

A composition of building material for architectural purposes has been patented by Mr. Carl Straub, of Syracuse, N. Y. It consists of glue, water, boiled linseed oil, and muriatic and sulphuric acids, to be used with calcined sulphate of lime and calcined carbonate of lime, the compounding and use to be in a specially prescribed way.

A fire escape has been patented by Mr. John Dittrick, of Perth, Ontario, Canada. It has a shaft with two drums, cog wheel, and fan governor, and another shaft with cog wheels in combination with a drum and two descending ropes, to be placed in a building near a window frame, and operating so that each descent serves to set the opposite rope ready for another descent.

A hat holder has been patented by Mr. Edmund B. Culver, of Great Barrington, Mass. It consists of a spring strip, a hook, and an elastic band, the latter serving as a connection between the strip and hook in such way that the hat may thereby be suspended from the clothing of the person or from any fixed support.

A guard for windows and doors has been patented by Mr. Alfred Heath, of Jersey City, N. J. It consists of a single wire formed into a series of overlapping loops, with indentations formed at their points of intersection, and with screw-threaded ends and nuts, making an easily detachable guard for windows and the like, to prevent children from falling out, etc.

An air ship has been patented by Mr. James M. Wheeler, of Fish's Eddy, N. Y. It consists of a boat with a mast, and aeroplanes fitted for bodily movement on the mast, with wings adapted to open and close as the planes are reciprocated, combined with a cylinder containing expansive fluid under pressure, with a piston and rod connections therefrom for operating the aeroplanes.

A telephone has been patented by Mr. Charles S. Bell, of Columbus, Ohio. The invention covers a multipolar magnet, composed of a permanent magnet having a longitudinal bore, with a soft iron core inserted therein, and an insulating cylinder of nonmagnetic material surrounding the core, with a helix surrounding the parts, in combination with the diaphragm of a telephonic instrument, and is intended to work in any place and way where a telephone connected with a battery can be worked.

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